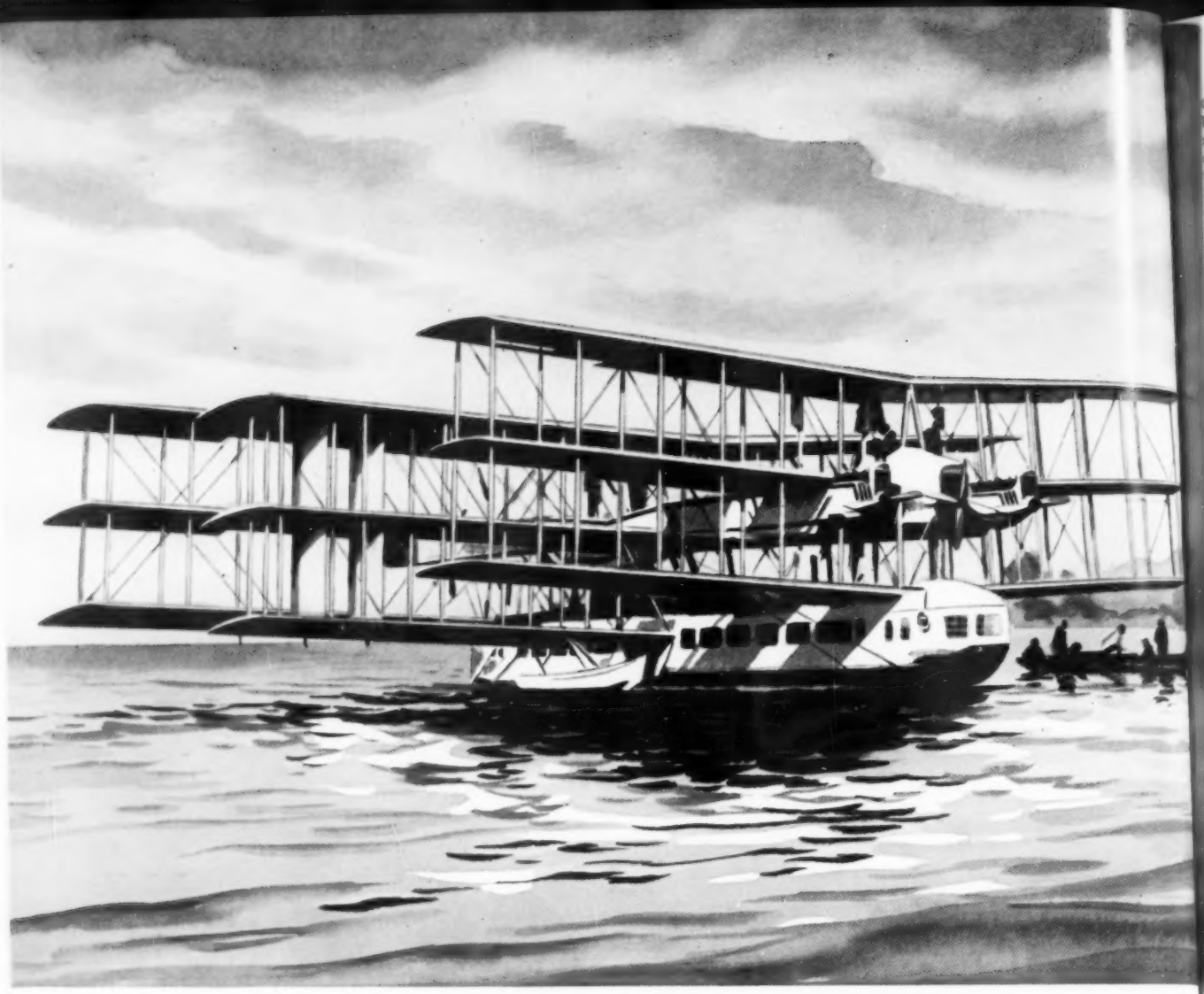
THE TOOL ENGINEER

September 1954

Precision Chucking

PUBLICATION OF THE AMERICAN SOCIETY OF TOOL ENGINEERS



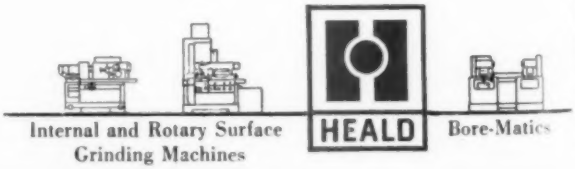
This one looked great . . . on paper

For all its nine wings and eight engines, the 25-ton "Epocha," built over 30 years ago by the Caproni Brothers, never got off the water. It *might have*—but it was destroyed by fire before the first test flight. Success or failure? The world will never know. Yet multiple wing types, favored by many early designers, are just memories now—left far behind in the competitive struggle for existence.

Competition is a mighty strong force today. Because of it, manufacturers everywhere are seeking new ways of improving product quality and cutting manufacturing cost. That's where we come in. For precision finishing on Heald machines can often make substantial savings in production time—help build a better, longer-lasting product, too.

Your Heald precision finishing specialist will be glad to show you how the latest developments in automation, way-type and transfer Bore-Matics, new grinding methods and interchangeable tooling can be applied to advantage on your production line.

Competition is wonderful if you're *ahead* of it. Our business is to help keep you there. That's why IT PAYS TO COME TO HEALD.



Internal and Rotary Surface Grinding Machines

Bore-Matics

THE HEALD MACHINE COMPANY

WORCESTER 6, MASSACHUSETTS

Offices in Chicago • Cleveland • Dayton
Detroit • Indianapolis • New York

Cover: How a part may best be held during various manufacturing operations is a fundamental question for the tool engineer. When avoidance of distortion and close tolerances are associated the search is likely to be intensified. Yet the jet engine symbolizes success in this field.

Solutions to problems involved in precision chucking of thin-walled parts are discussed in the article beginning on page 37.

The Tool Engineer

Volume XXXIII, No. 3 September 1954

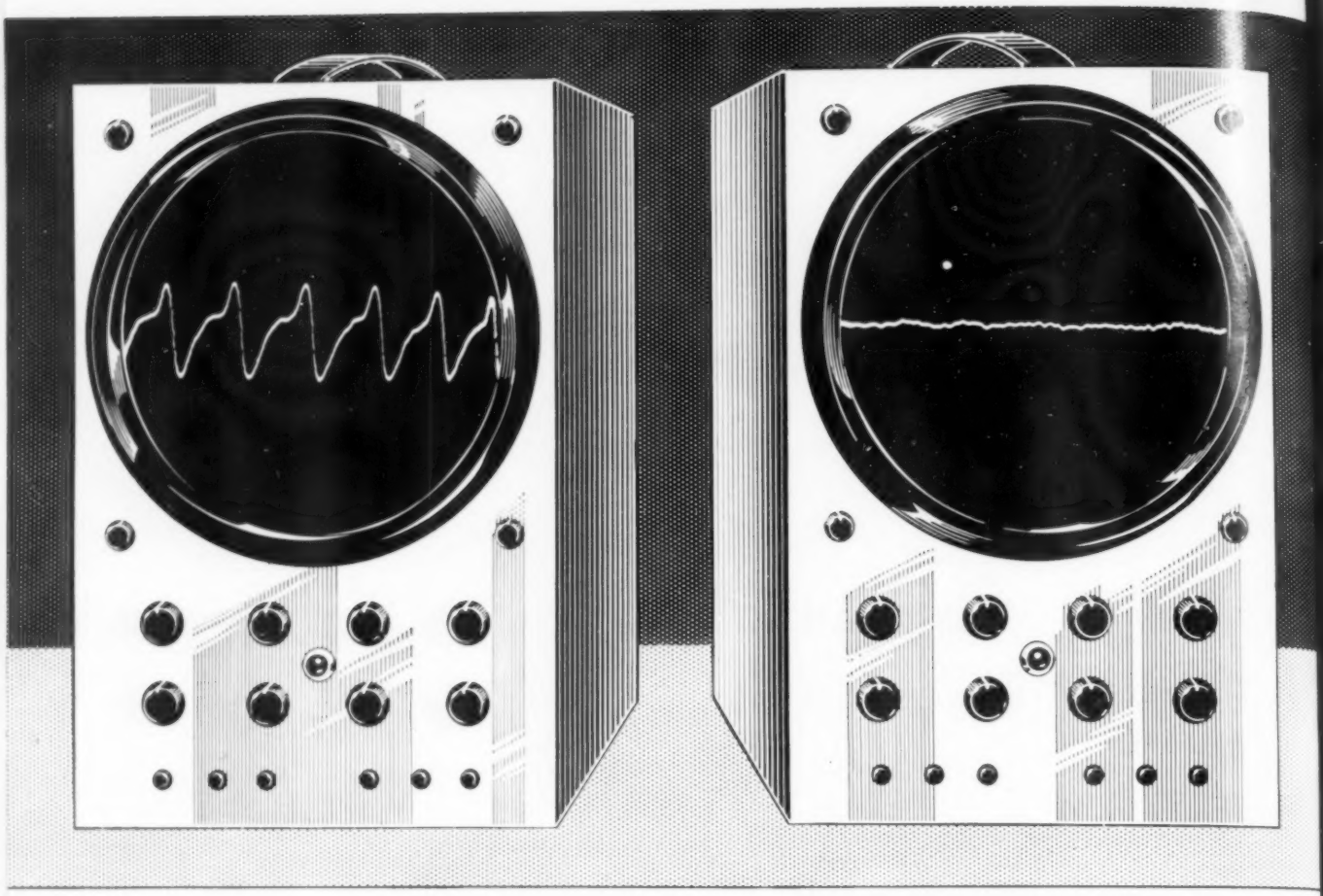
TECHNICAL ARTICLES

ASTE NEWS

DEPARTMENTS

PLANNING · ENGINEERING · CONTROL · TOOLING · EQUIPMENT · PRODUCTION

THE TOOL ENGINEER is regularly indexed in the *Engineering Index Service* and the *Industrial Arts Index*



WHEN A STRAIGHT MINERAL OIL was used to lubricate the ways, an 0.0008″ jump at frequency of 2.74 cycles per second was noted.

WHEN SUNOCO WAY LUBRICANT was used on the ways, the jump was too small to measure, proof that this medium stops slip-stick motion.

TEST PROVES SUNOCO WAY LUBRICANT ENDS SLIP-STICK TABLE MOTION

How effectively Sunoco Way Lubricant stops slip-stick table motion is graphically illustrated by these oscillograms. The pattern on the left was made with a straight mineral oil as the lubricant; the other was made with Sunoco Way Lubricant on the ways. Both patterns are magnifications of changes in rate of table travel and were obtained under identical conditions.

You can stop slip-stick table motion, protect the ways, get better surface finishes, cut production losses with Sunoco Way Lubricant. Try it in your shop. For more information, call your nearest Sun office or write SUN OIL COMPANY, Philadelphia 3, Pa., Dept. TE-9.

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY

SUNOCO

PHILADELPHIA 3, PA. • SUN OIL COMPANY LTD., TORONTO & MONTREAL

Refiners of the famous Blue Sunoco Gasoline and Dynalube Motor Oils

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The Tool Engineer

Teamwork Proves Effective

Without the cooperation of top management, the tool engineer cannot bring to fruition his ideas for improving production. No matter how effective his plans may be for producing a better product at a lower cost, they are but dreams unless implemented by the necessary appropriation for capital expenditure. Likewise, unless the men in the shop recognize that improvements also benefit them, plans may be thwarted through the labor union—even to the point of sabotage.

An enlightened management invests in the future through well planned capital expenditures and keeps faith with the shop man by fair play. Also, it shows him that what is good for the "economy" is good for him personally. Industrial history is full of sad experiences where this was not done.

Recently, the Kaydon Engineering Corp., a manufacturer of bearings, demonstrated how effective teamwork can actually be. Faced with the desire of obtaining a large contract in a highly competitive field, management met with the union to discuss the necessity of cost reduction. The contract would mean the employment of 100 men for one year. Careful analysis by tool engineers disclosed that over $1\frac{1}{4}$ million would be necessary for machine tools, equipment and special tooling to assist in reducing costs.

The union found that with increased efficiency, lower scrap and less rework the earnings of the employees would not be reduced even though the price of the product was. After several months of experience with the new tools and rates, everyone is completely happy with the results. This illustrates how effective cooperation and teamwork can be and may well serve as a model for other companies.

John W Greve

EDITOR

NEW and BETTER!

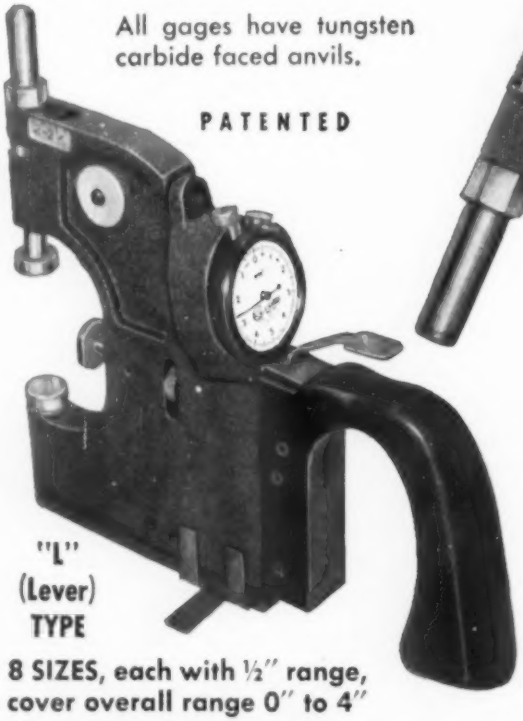
PARALLOC
DIAL SNAP GAGES

PARALLELISM PRESERVED

STANDARD'S new PARALLOC Dial Snap Gages introduce a new type of locking mechanism which maintains remarkably close parallelism between the anvil faces. Ordinary locking mechanisms tend to distort a portion of the frame in a way which swings the pin faces out of parallelism to a degree which is substantial in relation to close tolerances. In PARALLOC, the metal is merely squeezed *along the line of the pin axis*, leaving the parallel condition undisturbed throughout successive relockings of the anvil. *You can rely on parallelism with PARALLOC!*

All gages have tungsten carbide faced anvils.

PATENTED



"L" (Lever) TYPE

8 SIZES, each with ½" range, cover overall range 0" to 4"

"D" (Direct) TYPE

8 SIZES, each with 1" range, cover overall range 0" to 8"

★ **PARALLELISM of anvils maintained, unaffected by tightness of clamping.**

★ **CHOICE OF INDICATORS . . . any AGD indicator in sizes 1 or 2, with desired dial graduations.**

★ **TRIPLE PROTECTION; Protective indicator guards; "Capstan" sleeve acts as stop to keep gaging plunger within range of indicator, preventing distortion of indicator mounting; STANDARD's fully shockproof mechanism within indicator protects gears from damage.**

★ **ANVILS OVERHANG frame slightly to allow gage to be entered into narrow places and close to a shoulder.**

INDICATOR POSITION permits easy entry of gage into narrow recesses. Advantageously placed for observation.

FULLY ENCASED MOVEMENT AND INDICATOR protected against accidental damage.

CLIP-ON STAND holds gage firmly upright.

WRITE for new booklet, "NEWS", describing these and other new STANDARD developments.

STANDARD Gage Co., Inc.
Poughkeepsie, N.Y.

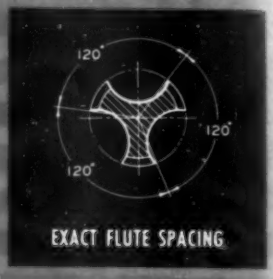
The Results You Need in hole-accuracy and long life

are realized from

BALANCED *Action*

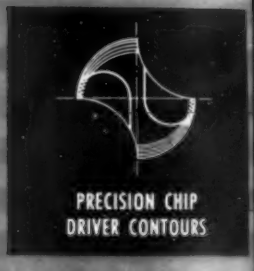
Taps by Winter

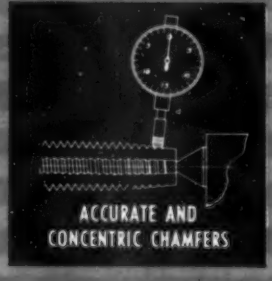
Here are the four principles of Winter Tap design and manufacture that result in Balanced Action:

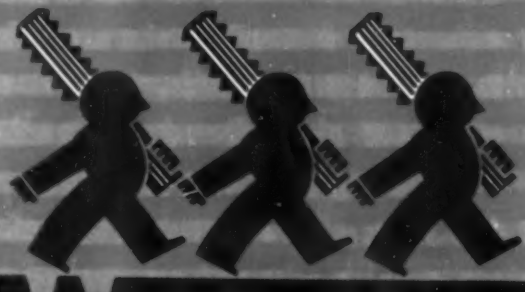


EXACT FLUTE SPACING


UNIFORM FLUTE CONTOURS


PRECISION CHIP DRIVER CONTOURS


ACCURATE AND CONCENTRIC CHAMFERS



WINTER

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Rochester, Michigan, U.S.A. Distributors in principal cities.
Branches in New York, Detroit, Chicago, Dallas, San Francisco.
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Your local Industrial Supply Distributor carries a complete stock of WINTER Taps.

END MILLS
can do work not possible with any other tools

—and National offers you End Mills for almost any need, *available from stock*. All have the famous National cutting edges. They'll give you smooth operation and long life.

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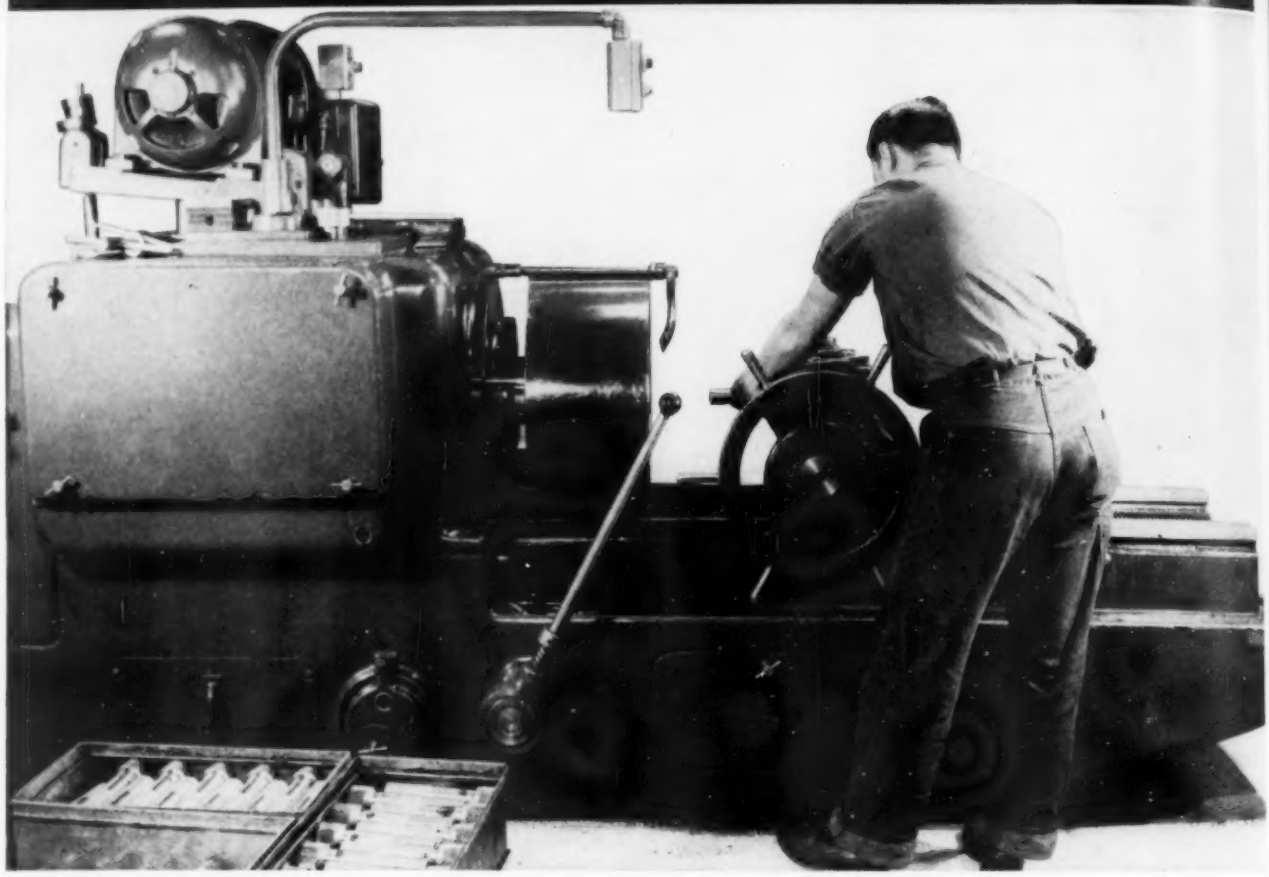
National

THE NO. 32C LANDMACO
For Cutting Large Diameter Threads



HARDENED and GROUND WAYS • WIDE SPEED RANGE • 60% MORE GRIPPING POWER • 6" CAPACITY

A New LANDMACO Threading Machine with many improvements and new design features has been developed for heavy-duty precision threading on large diameter work. The first installation of this new LANDMACO is shown threading "Unbrako" Screw Products of TS4140 steel at the Standard Pressed Steel Company, Jenkintown, Pa. 1½" diameter 12 pitch UN threads are being cut 2 29/32" long to a Class 3 fit.

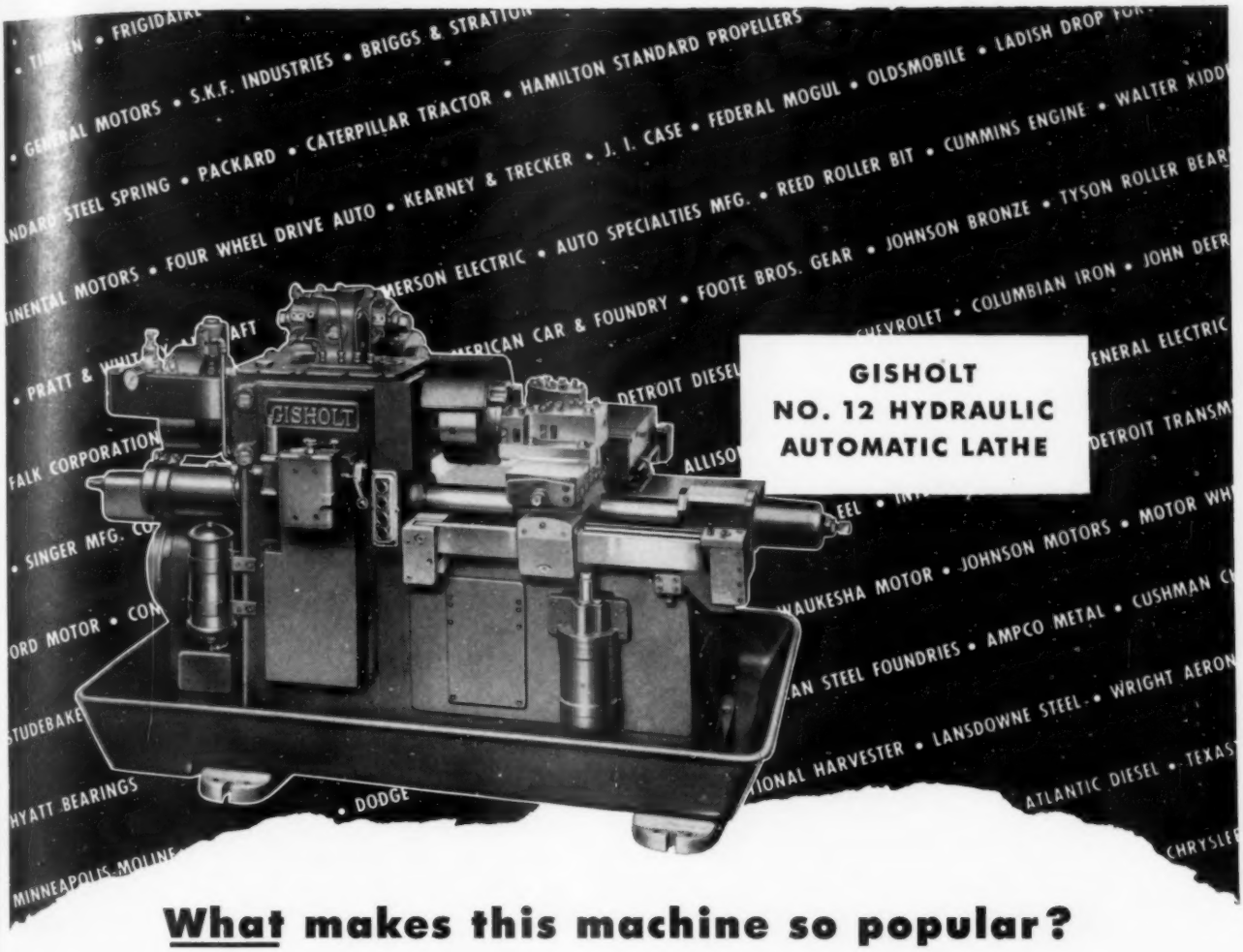
The carriage front, based on a new principle, assures proper work alignment under gripping pressure and gives 60% more gripping efficiency. Heavy hardened and ground rectangular ways firmly guide and support the carriage.

A single gear shift lever is provided for a rapid speed change of 25% for any given spindle speed as determined by the speed change gears in use. Three pairs of speed change gears provide twelve spindle speeds ranging from 9 to 152 revolutions per minute.

This machine is equipped with either the 4" Standard Rotary Head or the new 6" (6-chaser) Lanco Head. It will cut bolt threads from 1½" to 6⅝" in diameter, and pipe threads from 1" to 6" in diameter. Maximum thread length is 29" with leadscrew and 30" without leadscrew.

For more complete information on this **new** LANDMACO Threading Machine, write for Bulletin #H-45. 381-2

LANDIS *Machine* COMPANY · WAYNESBORO PENNSYLVANIA



What makes this machine so popular?

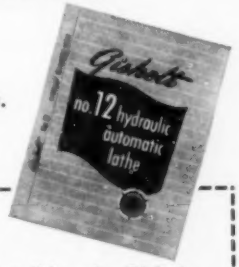
It's the simple basic application of hydraulic principles—perfected through the years. It's a single spindle machine that handles all classes of work—holding with a chuck or an arbor, with fixtures, or with a work driver for between centers. Front carriage alone will perform 14 different cycles. Independent rear slide can be positioned at any angle to the work. Feeds are infinitely adjustable...not limited by cams. Here's the versatility, the speed, the automatic cycle, and the easy change-over that mean big savings for scores of users. Why not for you?

If you have parts up to 12″ to produce at lower cost, look at the Gisholt No. 12 Hydraulic Automatic Lathe. Call your Gisholt representative. Or write us.

THE GISHOLT ROUND TABLE
represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

This new catalog will show you why.

All operating features are clearly described, fully illustrated. Here, too, are 28 different jobs to show many classes of work and tooling possibilities. Write for your copy.



Gisholt Machine Company
Madison 10, Wisconsin

Please send my copy of the catalog describing the Gisholt No. 12 Hydraulic Automatic Lathe.

Name.....*Title*.....

Company.....

Address.....

City.....*State*.....

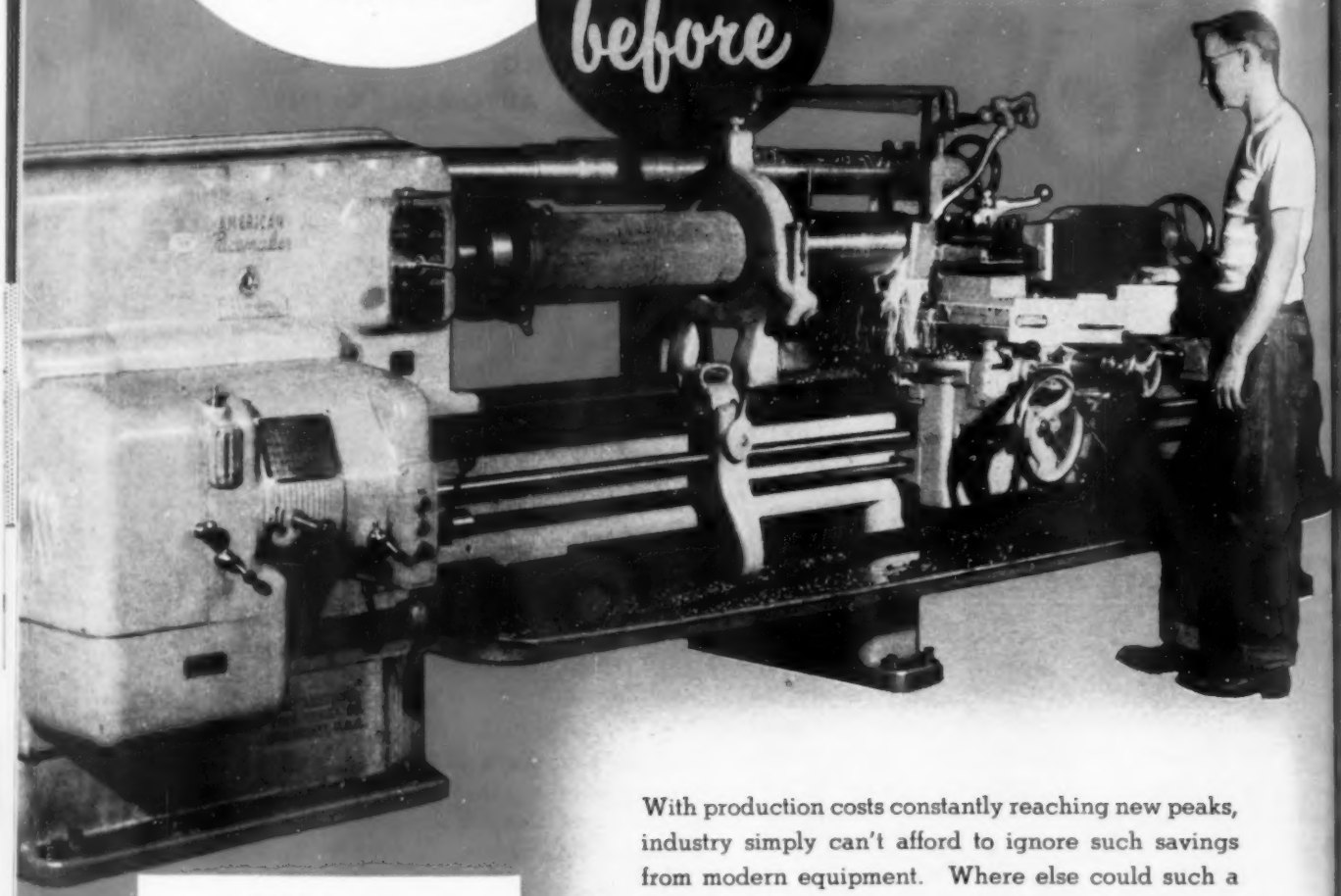
GISHOLT
MACHINE COMPANY
Madison 10, Wisconsin

TURRET LATHES • AUTOMATIC LATHES
SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

2¼ hrs. now

9 hrs. before

Fairbanks, Morse & Co., Beloit, Wisconsin, is *really* putting the payroll dollar to work with its new 20 inch "AMERICAN" Heavy Duty All-Hydraulic Duplicating Lathe.



2000 horse power Fairbanks-Morse motor shafts are now being rough and finished turned in 2¼ hours floor to floor against a former time of 9 hours per shaft.

With production costs constantly reaching new peaks, industry simply can't afford to ignore such savings from modern equipment. Where else could such a magnificent return upon an investment be secured, and how else can costs be lowered to meet an increasingly competitive market?

More production per man hour is the answer and the only answer to prohibitive costs—modern, high production machinery is the answer to greater production per man hour.

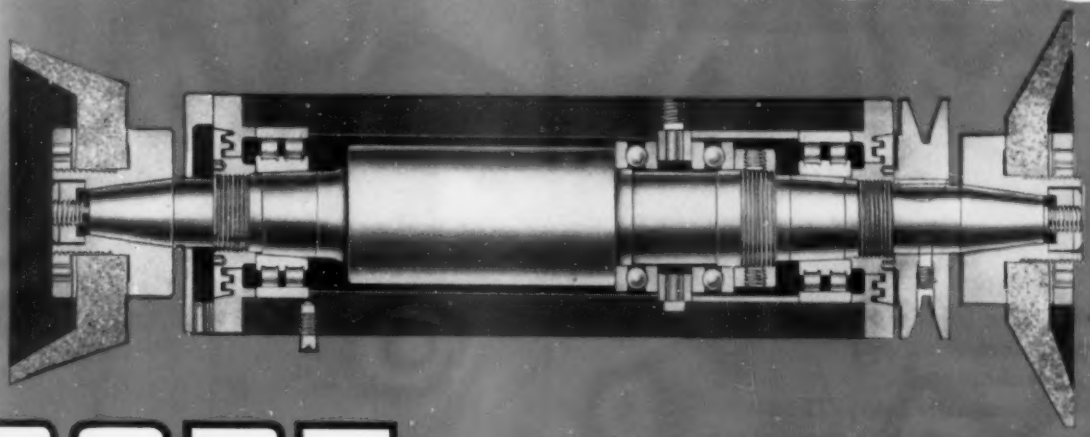
Put your payroll dollar to work for greater profits with "AMERICAN".

Bulletin No. 35 shows many examples—it's yours for the asking.

THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

AFTER 8,760,000,000 REVOLUTIONS



POPE PRECISION SPINDLES

with double row cylindrical roller bearings and ball thrust bearings will still be taking the load — still be producing superior finishes — still be *Precision* Spindles.

That is why you can *Specify* POPE Spindles with confidence

Send us your specifications and let our engineers recommend the one best Spindle for the job you are going to do.

No. 100

Specify **POPE®** PRECISION SPINDLES

POPE MACHINERY CORPORATION
Established 1920
261 RIVER STREET • HAVERHILL, MASSACHUSETTS

now you can get a finish

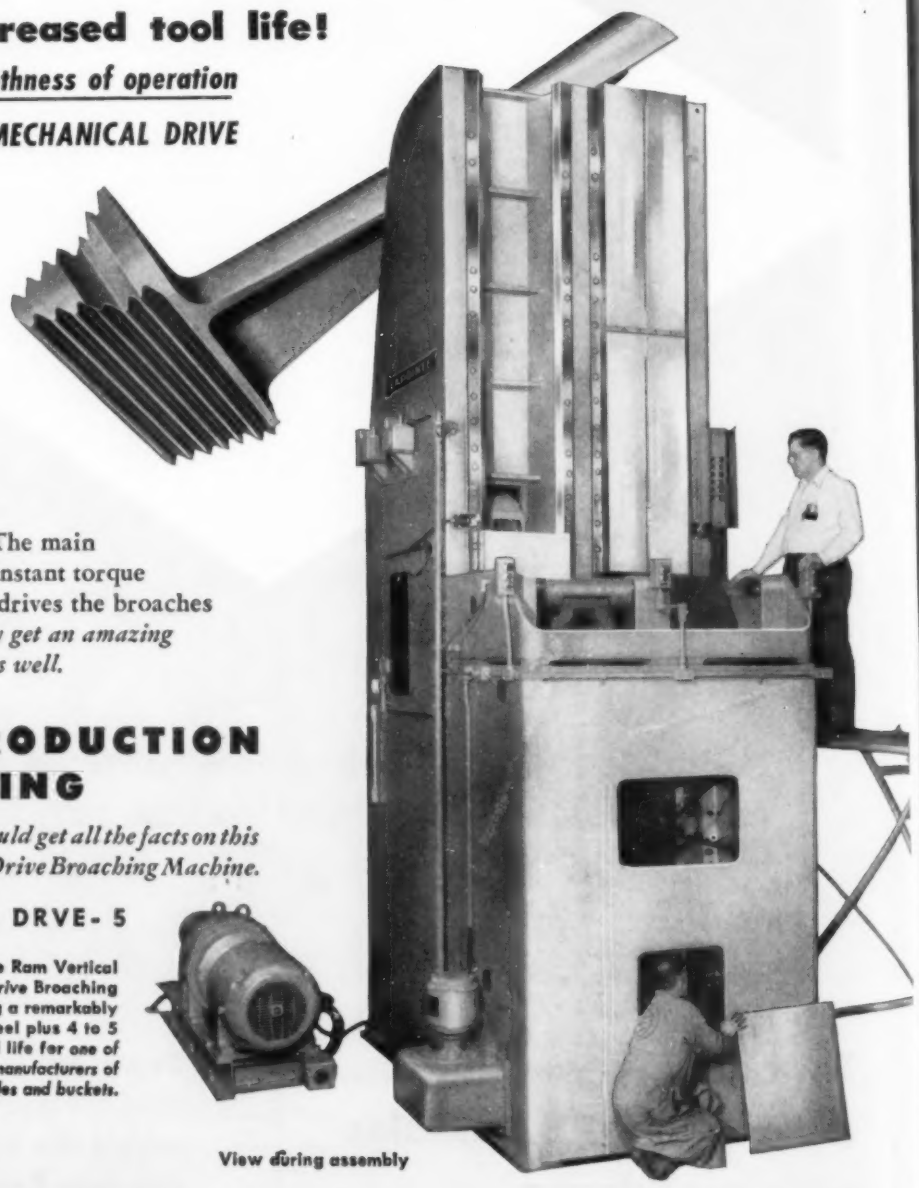
by LAPOINTE BROACHING

far superior to any finish ever before obtainable . . .

and 400% increased tool life!

The reason? . . . smoothness of operation

through the ELECTRO-MECHANICAL DRIVE



This machine is massive, weighing something over 30 tons without tools. Slides are unusually heavy. The main drive gear, powered by a constant torque variable speed D.C. Motor, drives the broaches so smoothly that *you not only get an amazing finish but increased tool life as well.*

for HIGH PRODUCTION BROACHING

of these and other parts, you should get all the facts on this newest LAPOINTE Electric Drive Broaching Machine.

WRITE FOR BULLETIN DRVE-5

This LAPOINTE Double Ram Vertical *Electro-Mechanical Drive* Broaching Machine is producing a remarkably fine finish on S 816 steel plus 4 to 5 times greater tool life for one of *the largest manufacturers of jet blades and buckets.*

View during assembly

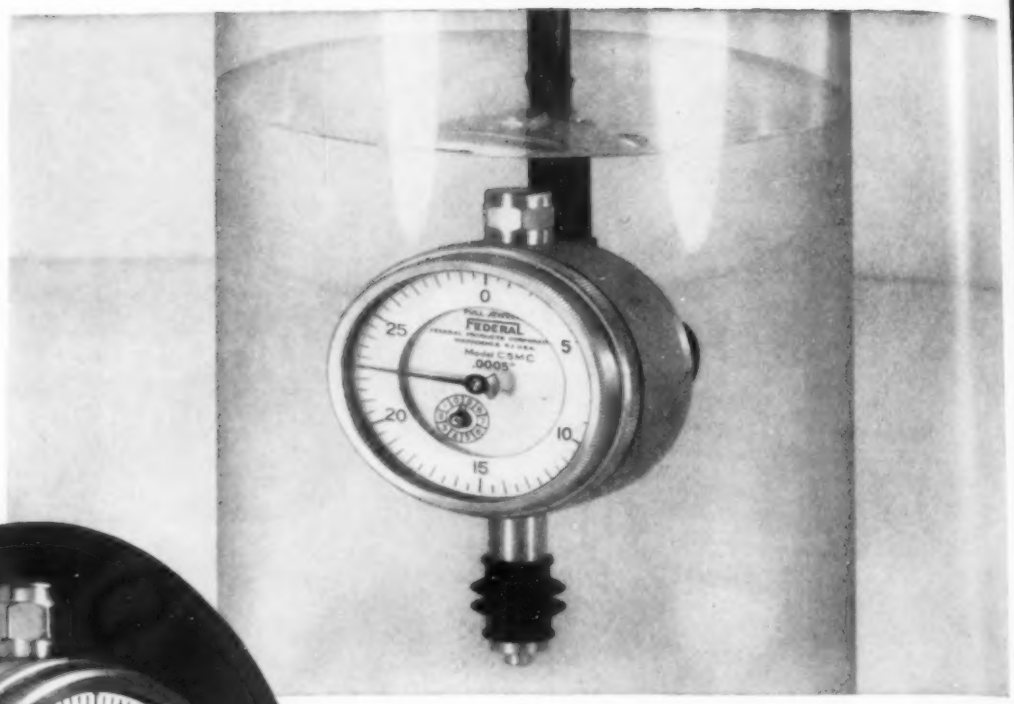
THE LAPOINTE MACHINE TOOL COMPANY

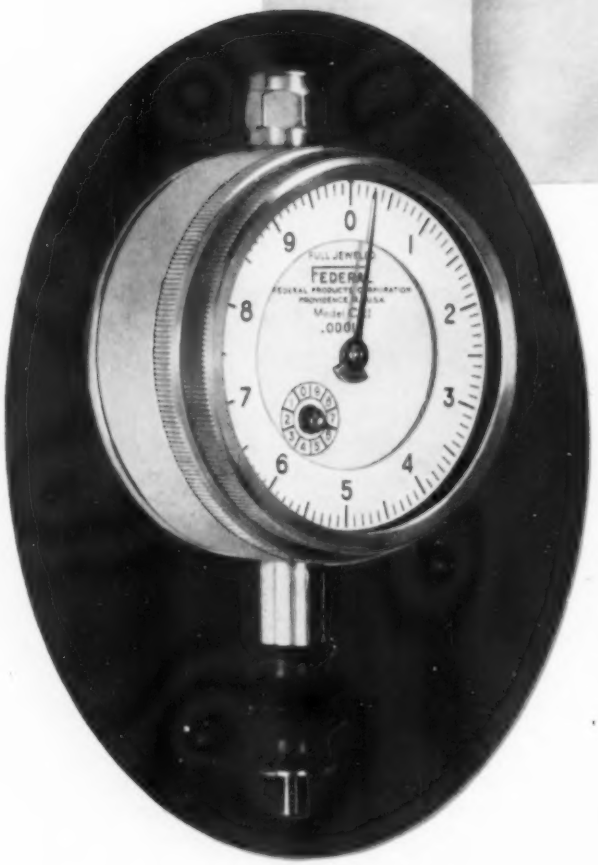
HUDSON, MASSACHUSETTS • U. S. A.

In England: Watford, Hertfordshire

HUDSON LAPOINTE MASS.

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES





You can splash, dunk, or spray this Wetproof Dial Indicator. It will give excellent performance and greatly cut maintenance costs.

AND NOW!
A WETPROOF DIAL INDICATOR

Completely Sealed—Wholly Protected from Coolant, Oil, Oil Fog, and other Liquid Contaminants

IN ANSWER TO REPEATED REQUESTS from Dial Indicator users, Federal now announces this WETPROOF DIAL INDICATOR which eliminates maintenance troubles commonly encountered under adverse operating conditions. "W" Series Dial Indicators are completely wetproofed and built unusually rugged to withstand heavy handling. The internal mechanism is protected by tightly sealed external openings. THE CRYSTAL IS OF GLARE-PROOF GLASS remarkably free of halations. It will not discolor when exposed to oil or staining liquids. A heavy duty case and four oversize back screws make these exceptionally durable Indicators. They are regularly furnished with revolution counter and Cushion Movement. The dial rotates for zero (0) setting. Available in "C" size (2¼" O.D.) and made to AGD specifications (except for minor variations). TRY THIS NEW INDICATOR ON YOUR TOUGHEST JOBS. Write

FEDERAL PRODUCTS CORPORATION
4199 Eddy St., Providence 1, Rhode Island

Ask **FEDERAL**

FOR ANYTHING IN MODERN GAGES...

Dial Indicating, Air, Electric, or Electronic—for Inspecting, Measuring, Sorting or Automatically Controlling Dimensions on Machines

The new Air Bore Gage brings to small run jobs the basic advantages of the Dimensionair's stable accuracy, precisely calibrated scale, fast set-up, and long range.

THESE ARE NEW

Adjustable AIR BORE GAGES

Get the advantages of extreme accuracy at low cost on smallest production runs

A MAJOR ADVANCEMENT IN AIR GAGING, Federal's Adjustable Air Bore Gages bring the sensitive accuracy and high magnification of the DIMENSIONAIR measuring system to job or to production runs. FOUR GAGES COVER A MEASURING RANGE FROM ½" TO 8". Their light weight makes them very easy to handle. Particularly in the larger sizes and where holes with large diameters are difficult to reach, these light weight gages provide a convenient, non-fatiguing method of checking holes with air.

Since the centralizing contacts are concentric with the axis of the gaging contacts, the gages can be set with gage blocks and measurements transferred to a hole with no significant error. Repetitive accuracy is outstanding. Learn more about this latest development in air gaging. Write

FEDERAL PRODUCTS CORPORATION
4199 Eddy St., Providence 1, Rhode Island

All models of Adjustable Air Bore Gages are regularly furnished with Tungsten carbide gaging contacts. These gages can be used with either the 2500 TO 1 MAGNIFICATION or 5000 TO 1 MAGNIFICATION Dimensionairs, including those now in use throughout industry.

Ask **FEDERAL**

FOR ANYTHING IN MODERN GAGES...

Dial Indicating, Air, Electric, or Electronic — for Inspecting, Measuring, Sorting or Automatically Controlling Dimensions on Machines

"STANDARD for cutting metal and costs since 1881"

Red Shield says:

Cut machining costs . . . standardize with Standard. Complete line . . . top quality tools. Backed by factory application specialists coast to coast. Distributors in all principal cities.

STANDARD TOOL CO.

3950 CHESTER AVENUE CLEVELAND 14, OHIO

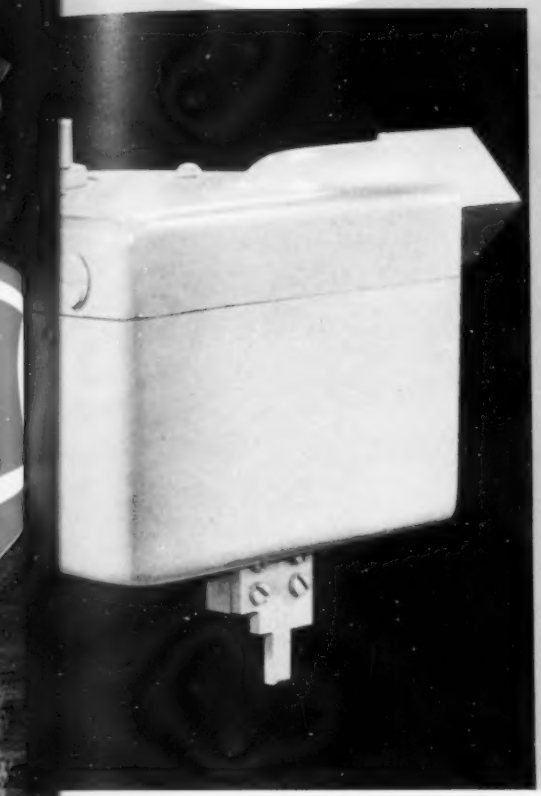
FACTORY BRANCHES IN: NEW YORK • DETROIT • CHICAGO • DALLAS • SAN FRANCISCO

THE STANDARD LINE: *Twist Drills · Reamers · Taps · Dies · Milling Cutters · End Mills · Hobs · Counterbores · Special Tools*

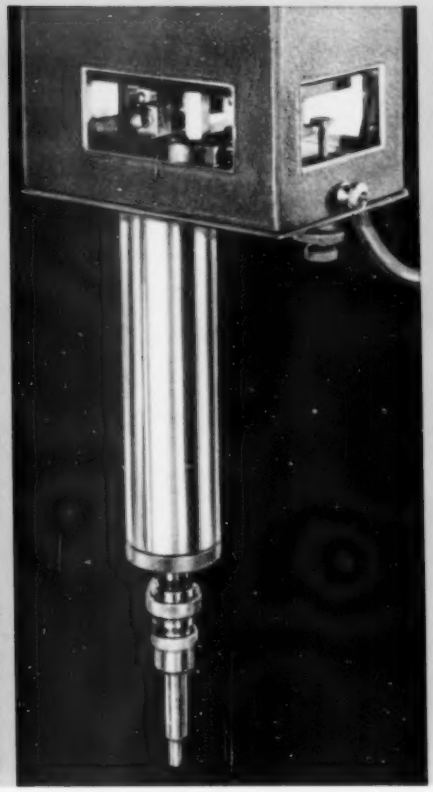
3 Heads are Better Than One

✔ CHECK THE *THREE* TRACER CONTROLLED TURNING METHODS OFFERED BY MONARCH—

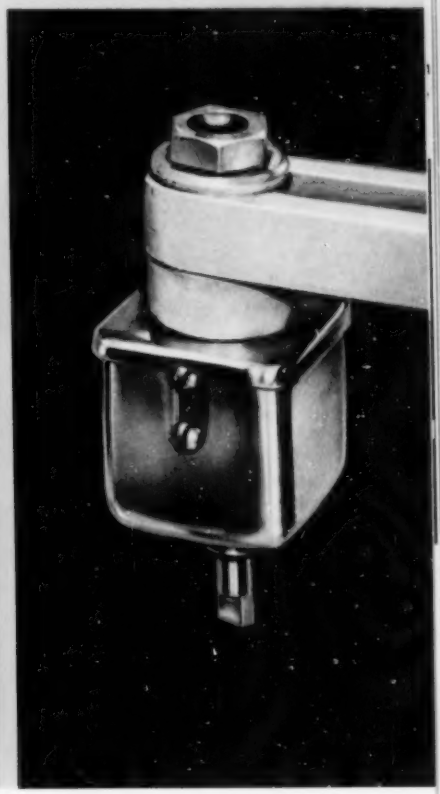
PIONEER AND LEADER IN THE TRACER TURNING FIELD



The Motor-Trace . . . for fast, repetitive shaft turning at its economical best—for step boring and step facing.



Monarch-Keller Controls . . . recommended for more intricate shaped molds and dies, for form rolls and other parts.



The Air-Gage Tracer . . . for turning multiple diameter shafts and turning, boring and facing contours.

Why Tracer Controls?

Tracer controlled automatic single-point turning slashes setup time and machining time; cuts tooling costs; reduces tool-crib inventories; in many cases, materially reduces or even eliminates subsequent grinding operations; delivers a high degree of accuracy; by reducing the chance for human error, practically dispenses with work spoilage. In many fewer words, as the job examples on the next three pages prove, it gives you PEAK PRODUCTION AT LOWER COST—for long runs and short ones.

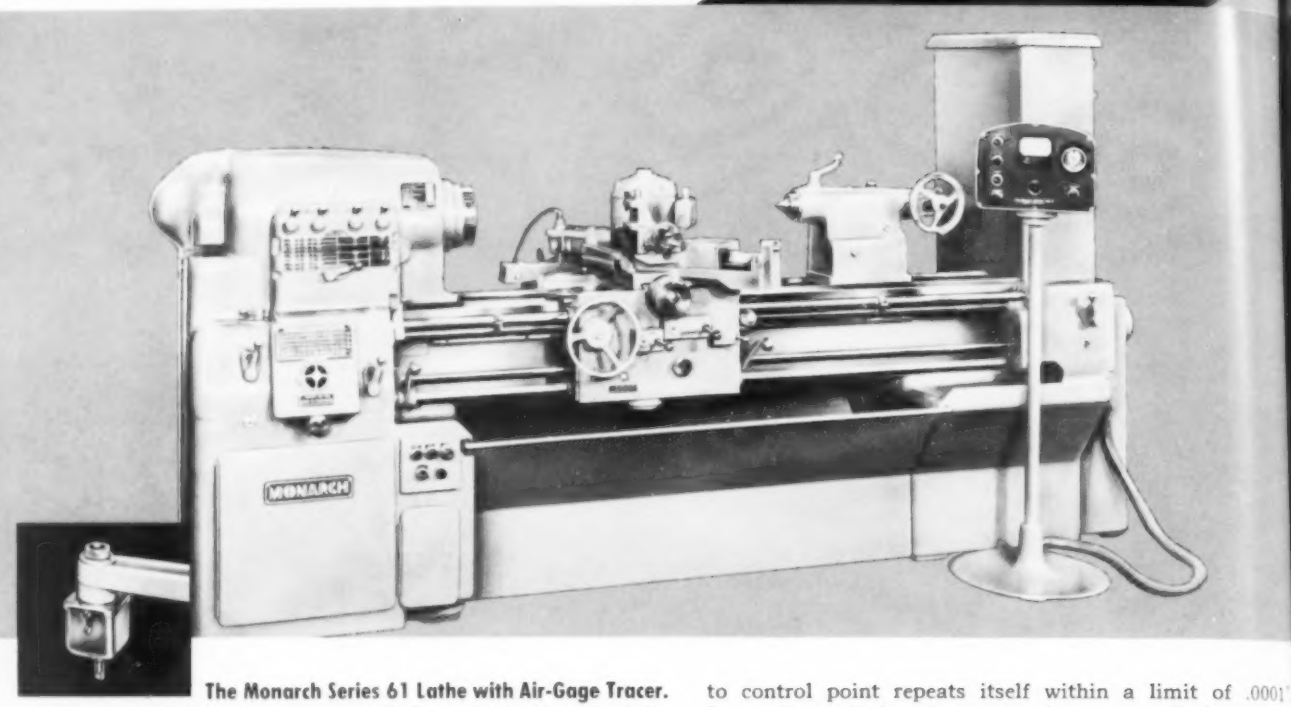
Why Monarch Tracer Controls?

They're our babies! We pioneered Monarch-Keller Controlled Turning 24 years ago—and have been pioneering, proving, producing, refining and innovating ever since. You choose from our 3 types the one suited for your job, and at least one type is available for every Monarch lathe. They use all duplicating methods—round or flat templates, micrometer heads or gage blocks. And they've been used on more lathes, for a greater variety of operations, than any other types of tracer controls. Go Monarch—trace it and save!

IMPROVE QUALITY ▸ **CUT COSTS** ▸ **BOOST OUTPUT**

(See Examples on Next 3 Pages)

TRACE IT AND SAVE with the Monarch AIR-GAGE TRACER



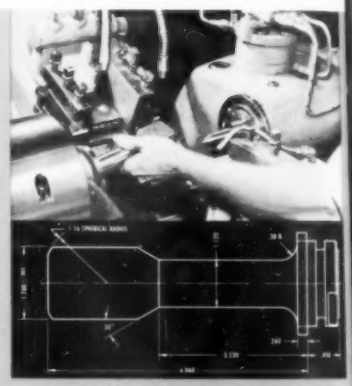
The Monarch Series 61 Lathe with Air-Gage Tracer. Hydraulically operated, controlled on air-gaging principle, this is the most accurate duplicating device on the market. With tracer stylus operating on a pressure of only 5-6 ozs., change in template contour converts to corresponding tool position in thousandths of a second and movement of slide to control point repeats itself within a limit of .0001". It can be applied as factory equipment on all sizes of 10" to 32" machines, the Mona-Matic and Right Angle Lathes—exclusive swiveling type optional. With the Auto Cycle Unit any Monarch Lathe equipped with Air-Gage Tracer Controls becomes a fully-automatic, high-production unit.

WHAT IT DOES

1. Imparts a smooth, stepless finish because of the continuous, single tool cut.
2. Provides automatic sizing.
3. Eliminates the necessity for repetitive measurements.
4. Generally reduces by half the amount of stock left for grinding.
5. Often eliminates hand polishing or grinding because of the fine finish imparted to the work.
6. Produces more accurate work than any other duplicating device.
7. Eliminates need for expensive forming tools and cost of multiple tool setups.
8. Allows complete setup change in fifteen to twenty minutes; tool change in one minute or less.
9. Permits the machining of practically any combination of diameters, tapers, bevels, forms, grooves, undercuts, shoulders, necks, radii and chamfers in a single continuous cut.
10. Reduces the chance for human error, thereby materially reducing the amount of spoiled work.
11. On many classes of work, saves time and money and provides better finish and accuracy than machining by multiple tool methods.

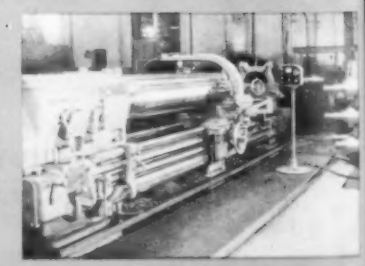
SAVE SETUP TIME

Part—fork 6" x 2" OD. **Material**—4130 chrome-moly forging heat-treated to hardness of 125,000—145,000 psi before machining. **Operation**—finish turn. **Machine**—Monarch Mona-Matic with Air-Gage Tracer. **Comment**—job previously performed on 3 machines—turret lathe, engine lathe and grinder. Total time—50 min. Single Mona-Matic completely turns in 5 min.—*has reduced setup time from 3 hrs. to less than 20 min.* Try *this* on small lots!



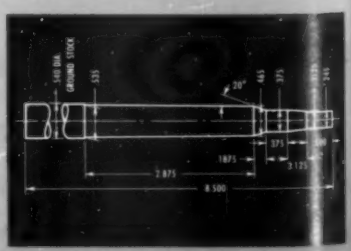
SAVE MACHINING TIME

Part—printing press roll. **Material**—SAE 1045 forging. **Operation**—turn complete. **Limits** — bearing shoulder spacing + .001" and — .000". **Machine**—Monarch 25" x 144" Model N Engine Lathe with Air-Gage Tracer and Auto Cycle Unit. **Comment** — former turning time was 7½ hrs. per piece. Monarch turning time is only 1½ hrs. per piece. *Five times the production!*

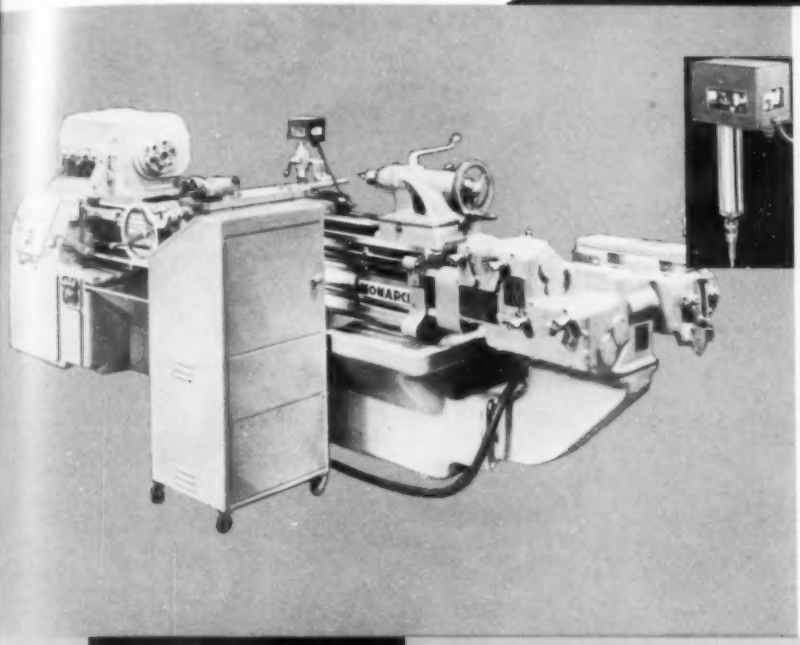


SAVE ALL THE WAY!

Part — reamer blank. **Material** — high speed steel. **Operations Performed**—turn complete excepting .540" diameter. **Maximum Depth of Cut**—7/64". **Limits** — ± .001". **Total Machining Time**—3 minutes 36 seconds. **Machine**—10" Precision Manufacturing Lathe. **Comment**—three cuts are required so as not to spring work. The above production was secured immediately by an operator who had never seen an Air-Gage Tracer equipped machine. *Customer estimates that savings will pay for machine in less than one year.*



TRACE IT AND SAVE with MONARCH-KELLER CONTROLS



Monarch-Keller Form Turning Machines, pioneer of all tracer controlled lathes, have been delivering results for almost 25 years. Magnetic clutch operated, electric tracer controlled through the medium of a push button control stand. Clutch energization occurs in 1/125 second—practically instantaneous response to template contour change, which is reproduced on work to accuracies of ± .001″ or less. Monarch-Keller Controls can be applied to all Monarch Lathes 16″ swing and up—are used on Shapemaster Engraver and Heavy Duty Roll Turners.

WHAT IT DOES

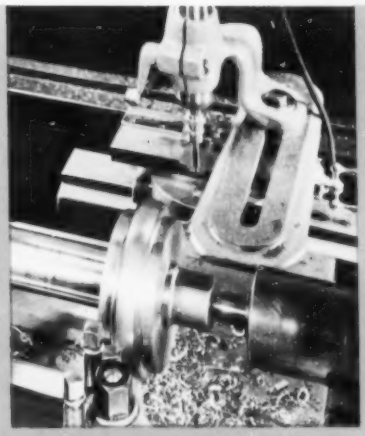
1. With its unique universal stylus movement, very slight pressure creates feed toward, parallel to and away from center line of machine. Substantial savings are thus effected in turning, boring and facing irregular contours, intricately shaped molds and dies, form rolls and other intricately shaped parts.
2. Affords time savings over conventional methods of from 80 to 85% in many cases.
3. Reduces greatly the stock left for grinding.
4. Ease and speed of setup are equally advantageous for both long production runs and small lot work.
5. Affords tooling savings especially pronounced in the elimination of form tools in form roll turning.
6. Duplicating template contours, human error is eliminated and work spoilage greatly reduced. In turning form rolls, there is no need for pairing rolls.
7. Does not limit length or diameter capacity, and has power to take heavy cuts up to the capacity of the lathe used.
8. Controls can be engaged and disengaged at the flick of a switch, making machine available for use under manual control.
9. Electrical control stand can be located to operator's convenience.
10. Controls can be factory-applied to all Monarch Lathes 16″ swing up, or such machines factory-prepared, at slight additional cost, to receive them later in field.

SAVE SETUP TIME

Form Roll for automobile body decorative strips. This job typifies a class of turning that can be handled by Keller controls at savings which cannot be approached by any other method.

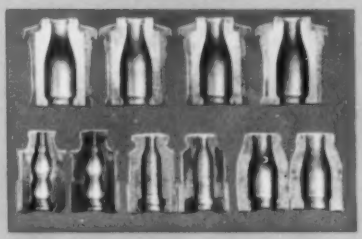
Material is air hardened steel. A carbide cutting tool is used and each roll is both rough and finish turned during the same setup. Maximum depth of cut is 1/32″.

Average turning time for a pair of rolls is slightly over 70 minutes. *Setup time is only 4 minutes per roll,* giving great economy when shifting over from one operation to another.



SAVE MACHINING TIME

Bottle moulds bored on the Monarch-Keller Lathe. Time required to rough and finish each set of moulds shown here is from 30 to 40 minutes. Usually, on a Monarch-Keller Lathe, the more difficult the nature of the work, the more time is actually saved by doing it with the Monarch-Keller method.



SAVE ALL THE WAY!

Goblet mould set. Photograph shows a goblet mould set made on a 16″ Monarch-Keller Lathe. Total machining time required is 11 hours, 39 minutes. Prior to the use of this machine, 44 hours were required for the same operations.

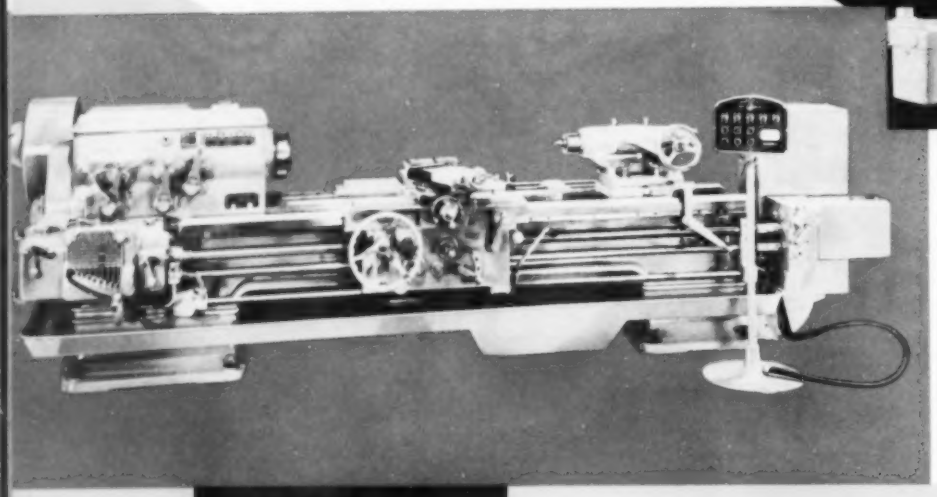
On this basis of saving, the Monarch-Keller Form Turning Machine would *pay for itself in less than one year.*

Monarch TURNING MACHINES

FOR A GOOD TURN FASTER • TURN TO MONARCH

FOR MORE COMPLETE MONARCH TRACER CONTROL INFORMATION — SEND COUPON ON NEXT PAGE

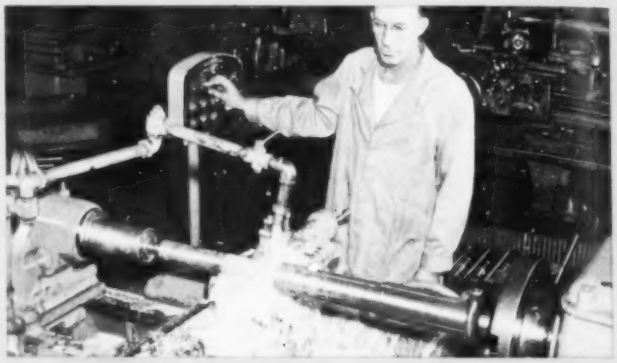
TRACE IT AND SAVE with MONARCH MOTOR-TRACE



Monarch 20" Heavy Duty Lathe with Motor-Trace. Here's fast, repetitive shaft turning at its economical best. With this electric motor operated, electric tracer controlled duplicating attachment, Monarch Engine Lathes become automatic cycle machines producing parts economically in quantities of 2 or 3 pieces and up. That's possible only because of the exclusive micrometer head method of tracer actuation. Applicable to 16" and 20" Monarch Lathes without reduction of normal swing capacity.

WHAT IT DOES

1. Makes it possible to convert a Monarch engine lathe from manual operation to automatic operation in less than one-half minute.
2. Saves time on lots as small as 2 or 3 pieces because total setup never requires more than 15 minutes.
3. On straight, multiple diameter work, provides accurate size control without tracer being in constant contact with a template. This allows use of micrometer heads, gage blocks or a simplified form of flat template.
4. Uses every second of the cycle to full advantage because tool rapid traverses at all times excepting when under actual cut.
5. Permits the pre-selection and automatic use of the correct feed for maximum cutting efficiency on each diameter. As many as five different feeds may be used on the same work piece.
6. Provides complete electric control from the point most convenient to the operator.



Save—with output like this. Part—shaft. Material—AISI 3140. Length—54⅜". Largest Diameter—4.125". Operations performed—turn complete. Number of feeds used on both ends—4. Maximum depth of cut—⅜". Cutting tool—carbide. Limits—± .002". Total machining time per piece—8⅕ minutes. Total handling time per piece—3¼ minutes.

TRACE IT AND SAVE WITH MONARCH

Toolmaker's Lathes—10" to 20" • Engine Lathes—10" to 32" • The Mona-Matic *for high production metal turning* • The Speedi-Matic *a fast, precision hand screw machine* • The Monarch Motor-Trace • The Monarch-Keller Turning Machine • The Monarch Air-Gage Tracer • The Monarch Roll Turning Lathes • The Monarch 60" Right Angle Lathe • The Shapemaster Engraver • Special Turning Machines

THE MONARCH MACHINE TOOL COMPANY
SIDNEY, OHIO

See preceding 3 pages for the story —send the coupon for full information

THE MONARCH MACHINE TOOL COMPANY, Sidney, Ohio

Gentlemen: Please send me without obligation the booklet(s) specified below:

___Air-Gage Tracer Booklet #2607.
___Monarch-Keller Booklet #2401.
___Motor-Trace Booklet #2302.
___Please have a Monarch Sales Engineer call with information.

NAME _____ TITLE _____

COMPANY _____

ADDRESS _____

CITY _____ ZONE ____ STATE _____

Monarch
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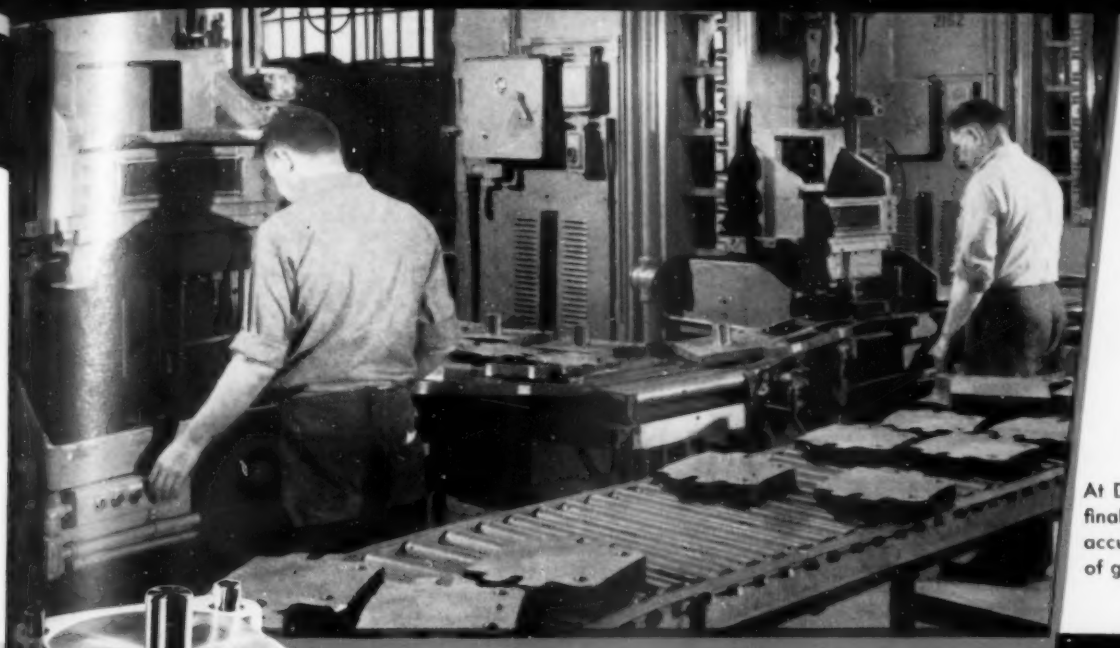
TURNING MACHINES

FOR A GOOD TURN FASTER • TURN TO MONARCH



At Danly's Chicago Plant . . . final broaching to assure accurate sizing and parallelism of guide post and bushing hole

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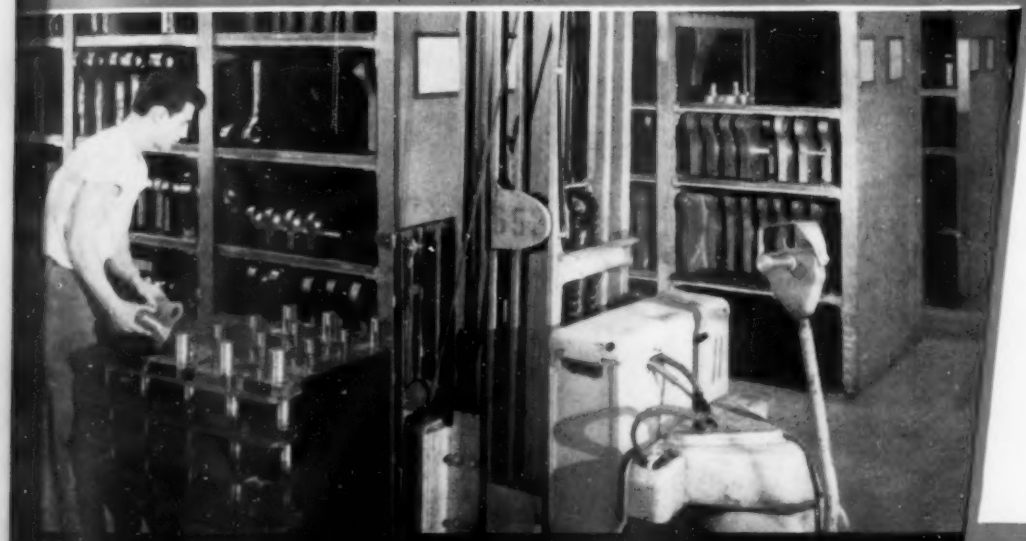

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1549 Temple Avenue
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*LONG ISLAND CITY 1
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Danly's new, faster service starts at the main Danly Plant in Chicago where two unique, high-speed, mass production lines are devoted exclusively to the manufacture of interchangeable, precision die set parts. Stocked by Danly Branch Plants in major toolmaking centers, these interchangeable parts are quickly assembled to make up the size and type of die set you need—and delivered to you only a few days after your order is received. Make a note right now of the Danly Branch nearest you from the list given on this page. Next time you need die sets, give your Danly Branch a call. See how they can meet your needs from stock . . . and save you time with fast, local service.

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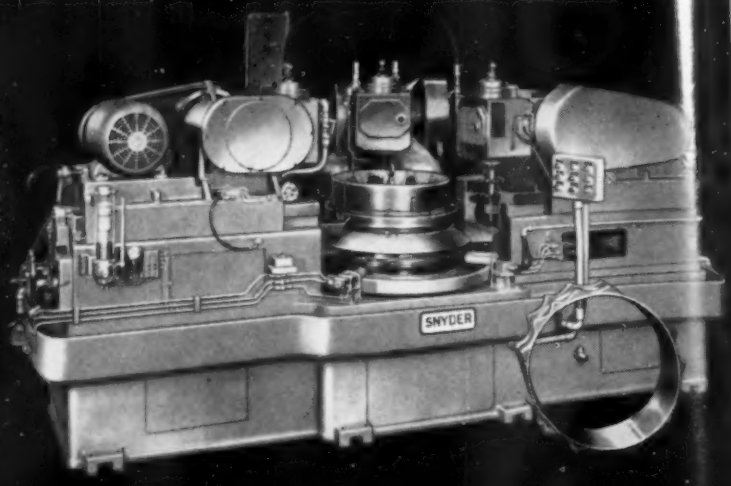
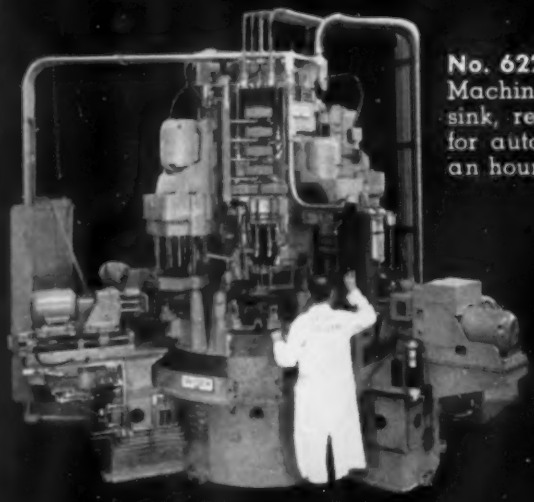
NEW BEDFORD, MASSACHUSETTS
(Division of VAN NORMAN CO.)
Warehouses in New York, Chicago, Detroit, Houston, San Francisco

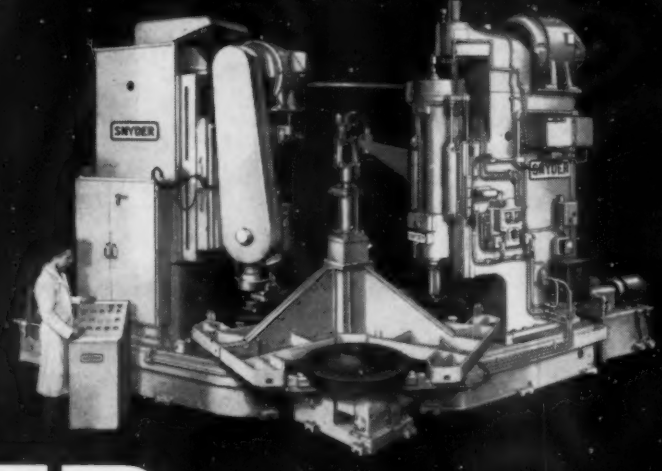
No. 68326—A three-way machine to profile mill four rows of lugs on a compressor casing for jet engines. 135 minutes are used to perform this operation in 3 steps.





No. 62207—Six Station Center Column Machine to drill, counterbore, countersink, ream and tap converter housing for automatic transmissions. 91 pieces an hour at 80% efficiency.

No. 67677—Two-Station, Vertical Column, Boring and Facing Machine to rough bore and face the hub of heavy railroad car wheels. Bore 6¾" x 7" long. 33 units an hour at 100% efficiency.



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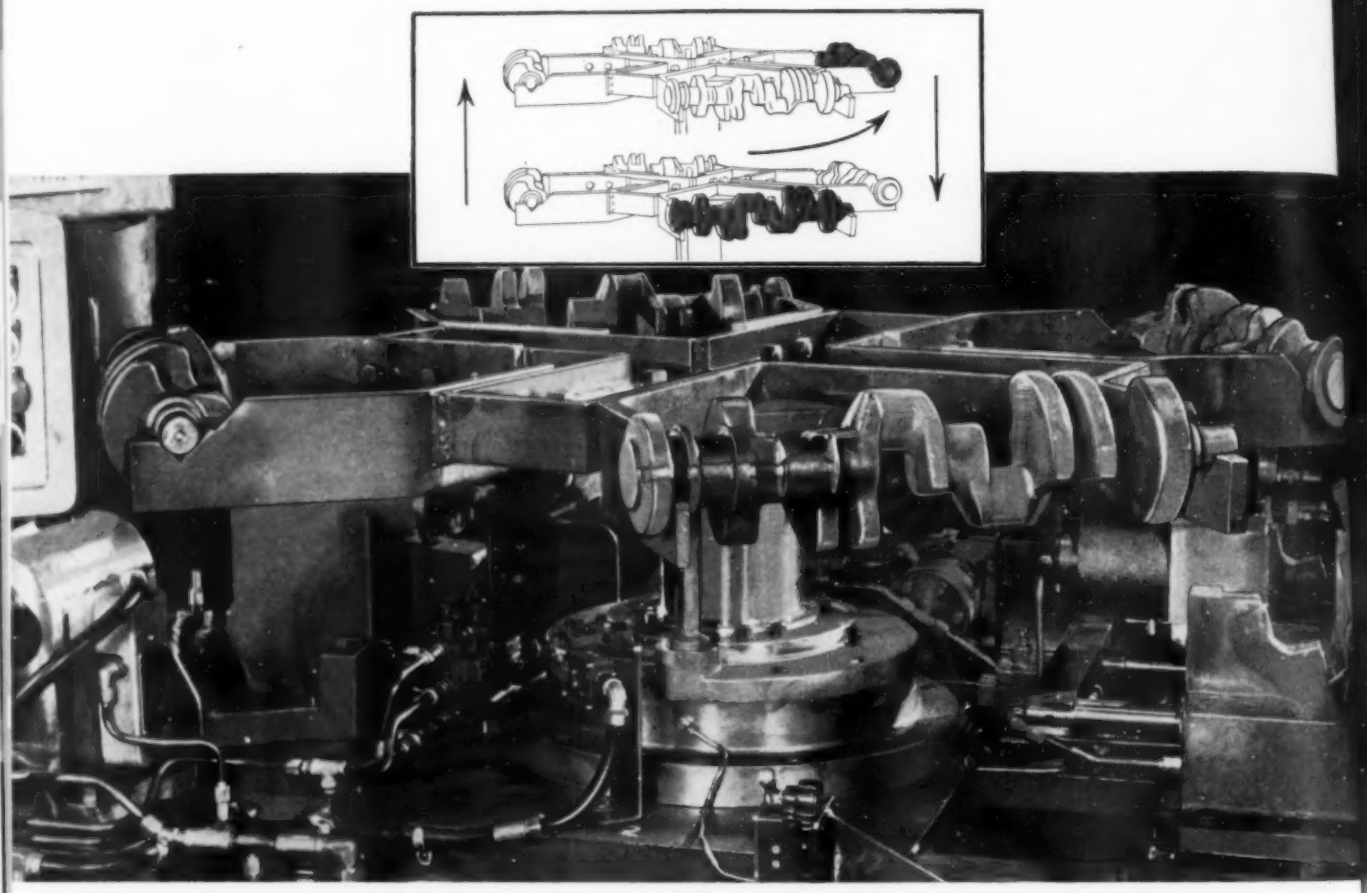
AUTOMATION TRENDS:

New rotary transfer design speeds milling, drilling and notching operations on crankshafts

Suggests new high-production possibilities for you



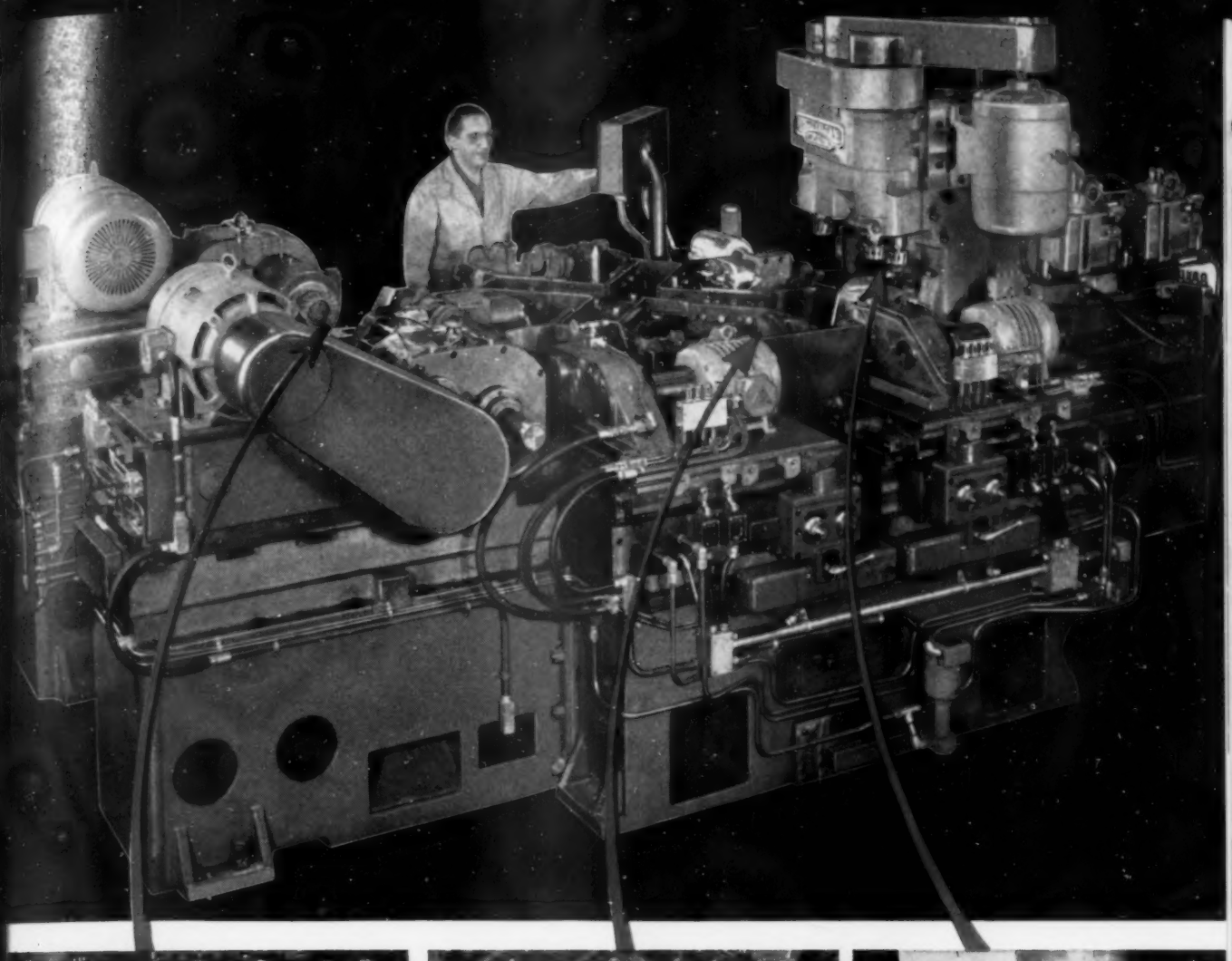
Hydraulic transfer unit of Kearney & Trecker's 4-Station Rotary Transfer machine is shown in raised position. Each of four arms carries one crankshaft. Diagram (above) illustrates vertical and rotational movement of transfer unit.

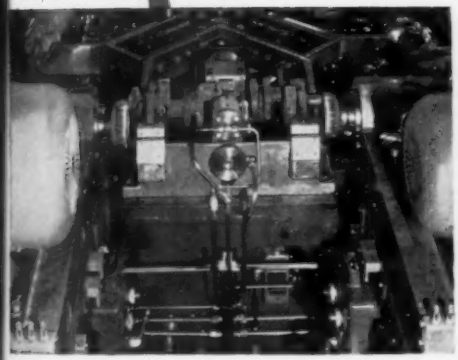
ANOTHER example of recent advances in production machine design is this Four-Station Rotary Transfer machine, shown at right, developed and built by Kearney & Trecker's Special Machinery Division. Engineered for high-speed production, the machine mills and center-drills the ends and mills the locating notches on automobile crankshafts. Production rate is 108 pieces per hour.

One of the outstanding design features incorporated in the machine is a special hydraulic rotary transfer mechanism which delivers the workpieces in sequence to machining stations where they are clamped by automatic fixtures. In addition, the machine comprises one drilling and two milling units all fastened to a common base. Three automatic hydraulic clamping and locating fixtures are also secured to the machine base.

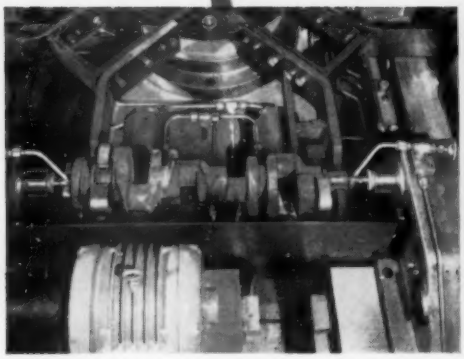
Here's how the rotary transfer unit helps to speed production. It raises four crankshafts at once... rotates and then lowers them into hydraulic clamping fixtures. Positive positioning is assured by a tapered rod mounted on the machine base which locates into one of four accurately drilled holes with inserted hardened bushings on the transfer unit base.

If you are faced with production problems that require special machinery — find out how Kearney & Trecker engineering and Special Machinery Division can serve you. Contact your Kearney & Trecker representative today.





At the first machining station, crankshaft ends are milled to length by two horizontal spindles carrying 6-in. dia. cutters. Spindles are powered by 10-hp and 7½-hp motors.



Ample coolant is supplied to the third machining station where crankshaft ends are center-drilled. Each of the two horizontal spindles is powered by a ¾-hp motor.

Six-spindle head, mounted on positioning sad mills locating notches on crankshaft. Head vances to a positive stop, moves to left, c pletes operation and returns.

Special Machinery Division

MILWAUKEE 14, WIS., U.S.A.

KEARNEY & TRECKER CORPORATION
Special Machinery Division
6784 W. National Ave.
Milwaukee 14, Wisconsin

Please send me Data Sheet No. 1036 with details on Four-Stat Rotary Transfer Machine. ☐ Check here if you would like have a representative call on you as soon as possible (or Milwaukee, GReenfield 6-8300)

Name.....

Title.....

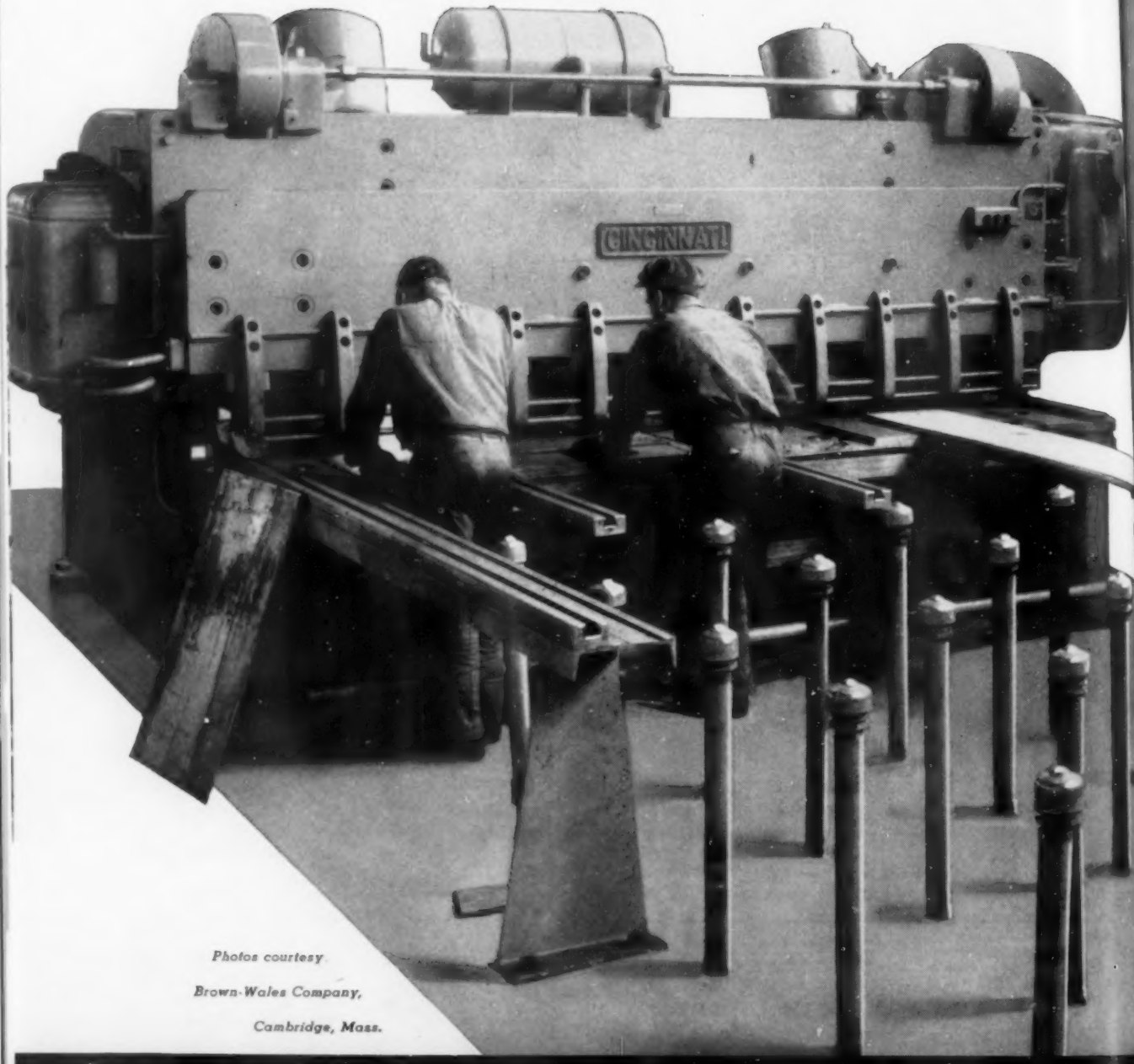
Company.....

Address.....

City..... Zone..... State.....

Test cuts

by accurate performance of



Photos courtesy
Brown-Wales Company,
Cambridge, Mass.

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

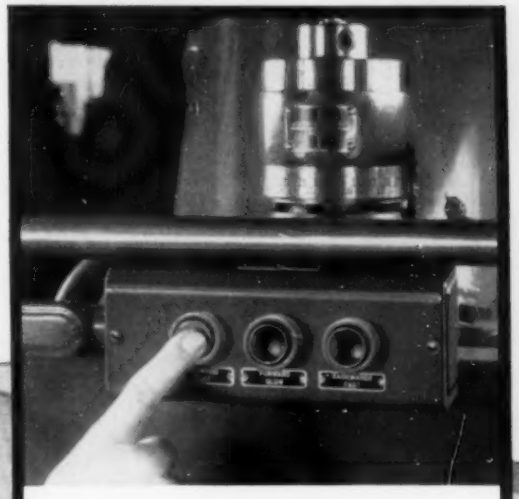
e iminated CINCINNATI Shears...

Brown-Wales Company says:

"As a steel warehouse, we have comparatively few production jobs, however, we have found that our men with this new shear can turn out far more work in an hour or a day than they could with the old one. In the first place, the power operated back gauge is a great time-saver when changing, as we frequently do, from one job to another.

"Secondly—the greater accuracy of the shear has made test cuts unnecessary, so that down time between runs is greatly reduced."

Write for Shear Catalog S-6.



The Buttons that save time. The great time-saver—the Cincinnati front controlled Power Back Gauge.

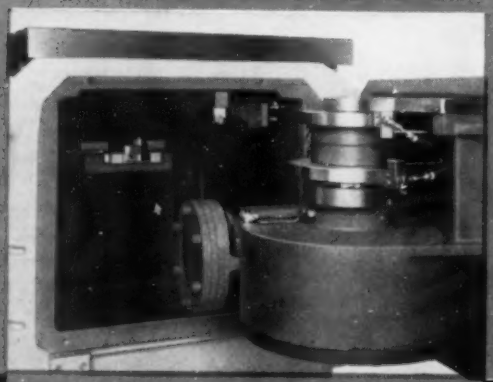
New!

XLO
EX-CELL-O for PRECISION

Flame Hardened Ways

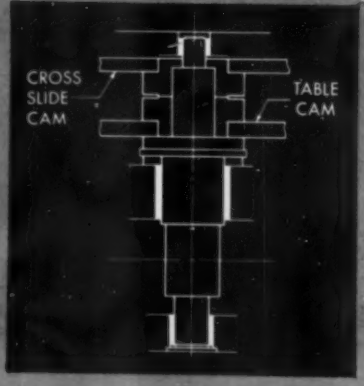
Rugged — For Tough Jobs. The base is a heavily ribbed nickel iron casting.

Drawing shows the 3-bearing shaft which supports the cams.



Cams Changed in *Minutes*

Just open the cam compartment and the cam assembly swings out for quick change of operation. All motors are outside the base.



Chip Problem Solved

Large chip chute is cast integral in the solid top of the base. There are no openings; chips or coolant cannot enter the base.

Direct Cam Action

★ NO LEVERS !

IN THE NEW STYLE 312 EX-CELL-O PRECISION BORING MACHINE

★ Fast

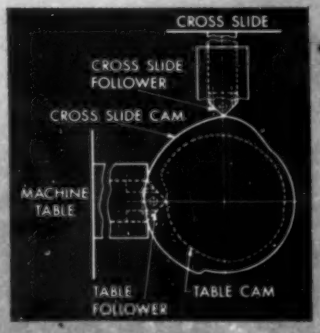
★ Accurate

★ Automatic

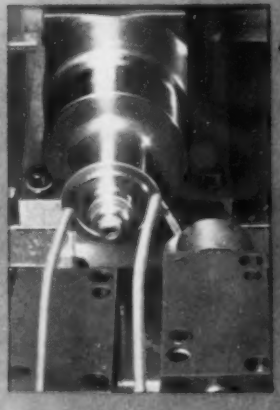
A New Method by EX-CELL-O

Direct Cam Action (NO LEVERS) for Sturdier Control

Added to Ex-Cell-O's line of Precision Boring Machines is the new Style 312, for precision contouring, boring, turning, facing and grooving operations.

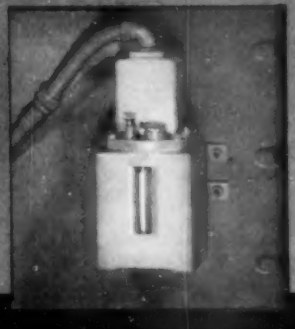


Drawing shows the contouring action. Note that cams act directly on the slides. THERE ARE NO LEVERS. There are separate cams for table and for cross slide, both being on one shaft to insure exact coordination.



Close-up view of a two-tool contouring operation on an aircraft washer. The part is chucked on the spindle; tools are carried on the cross slide.

Spindle is lubricated permanently.



Ways are lubricated automatically by pump.

Size Control

Graduated adjustment, on end of machine, positions the table relative to the work.

EX-CELL-O CORPORATION

DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

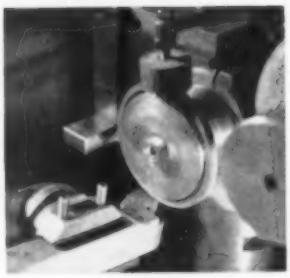
FOR MORE INFORMATION . . .

contact your Ex-Cell-O representative or write Ex-Cell-O in Detroit for literature.

54-43

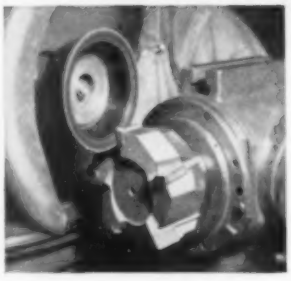
On any carbide grinding job...

Nothing cuts like a Norton diamond wheel



Norton Vitrified Bonded Diamond Wheels outperform all others of this type. They combine the fast cutting action of resinoid bonded wheels with resistance to grooving approaching that of metal bonded wheels. Great durability is another advantage.

◀ ***Production Grinding of Single Point Carbide Tools*** is most economical and efficient with Norton vitrified bonded diamond wheels. Grinding chip breakers, as illustrated, is another important job for which they are ideal.



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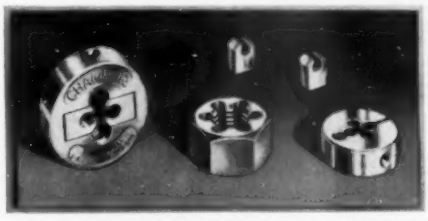

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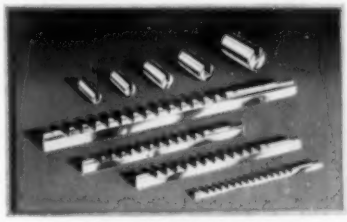

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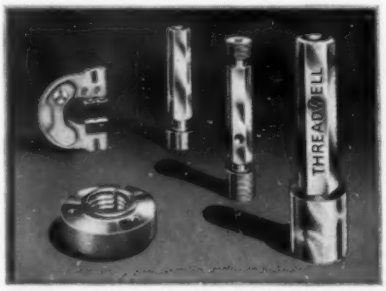

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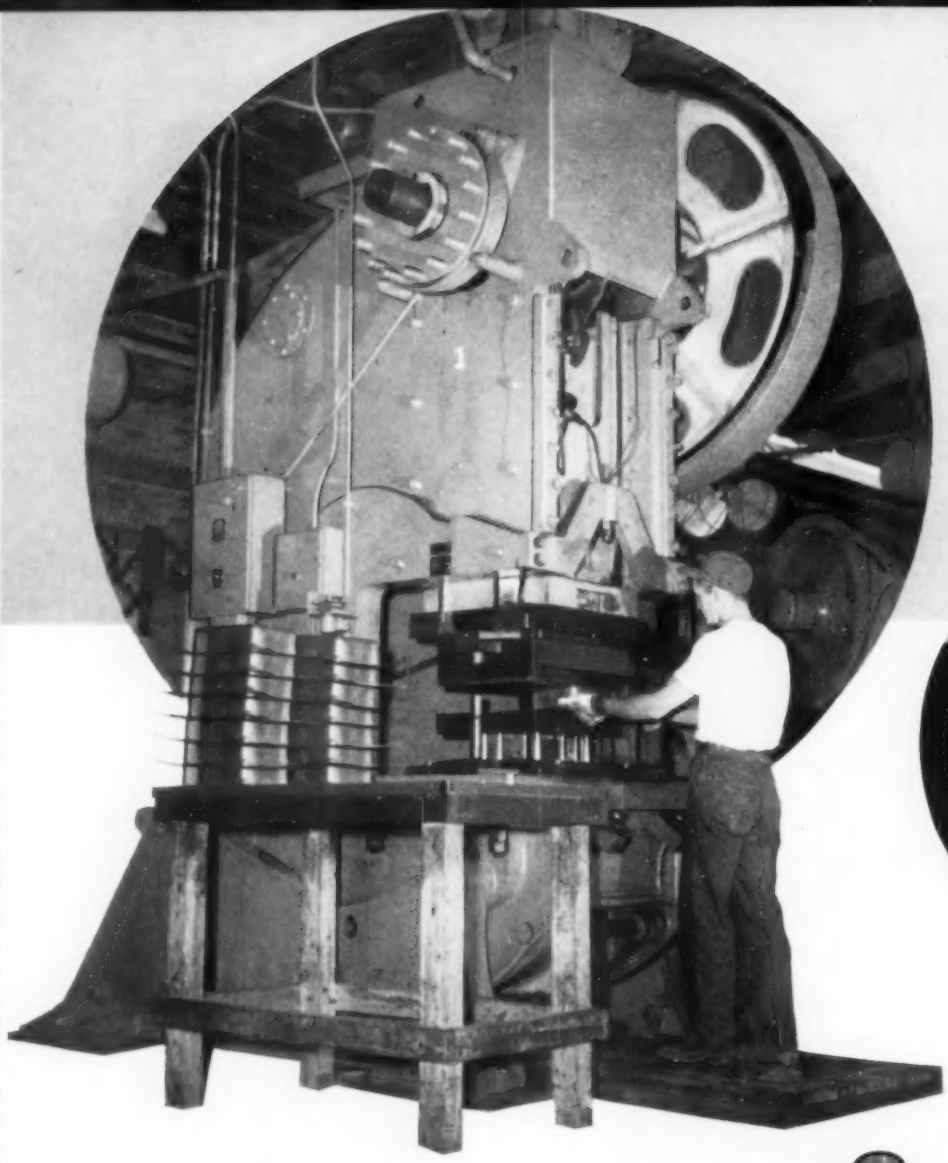

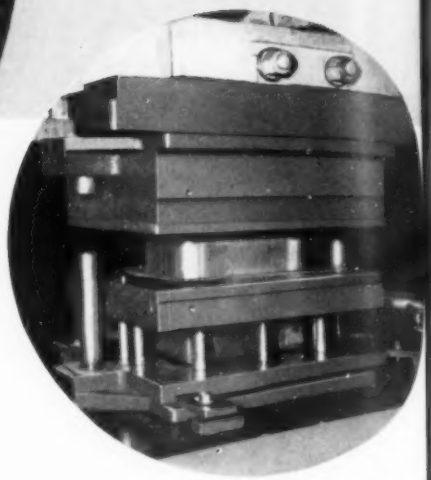

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The **Tool Engineer**

Are You Missing a Bet?

September, for most of us, represents the beginning of our monthly technical meetings after the vacation period. To me, attending these monthly meetings is inspiring. To see the eagerness that those present have in obtaining additional technical knowledge assures the continued growth of our Society.

The main speaker, of course, is always the chief drawing card, and his subject is usually responsible for the attendance of the majority of those present. A lively question and answer period generally follows an inspiring technical talk. Frequently, the speaker's exhibits keep the membership intrigued, even after the meeting is adjourned.

Contact with so many fellow engineers, however, is something you cannot obtain anywhere else. Discussions among various groups at the meeting is stimulating and beneficial. Our charter members founded this Society with the hope that dissemination of technical information among themselves would increase the technical knowledge of each. This interchange of information has been most successful and is the biggest asset of our Society. Many tool engineers' problems are solved at our monthly technical meetings.

Strangely enough, only about one-third of our membership avail themselves of this opportunity. Too many are satisfied with reading THE TOOL ENGINEER, attending expositions and perusing the "Tool Engineers Handbook." I often wonder if they realize just what they are missing.

As our new season of technical meetings get underway, I wish you would join me in making a resolution to attend the next monthly meeting. I am sure that we will find some knowledge that will make us better tool engineers.

Joseph P. Crosby

PRESIDENT
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precision chucking of thin-walled parts

By K. W. Cole
Chief Designer
N. A. Woodworth Co.
Detroit, Mich.

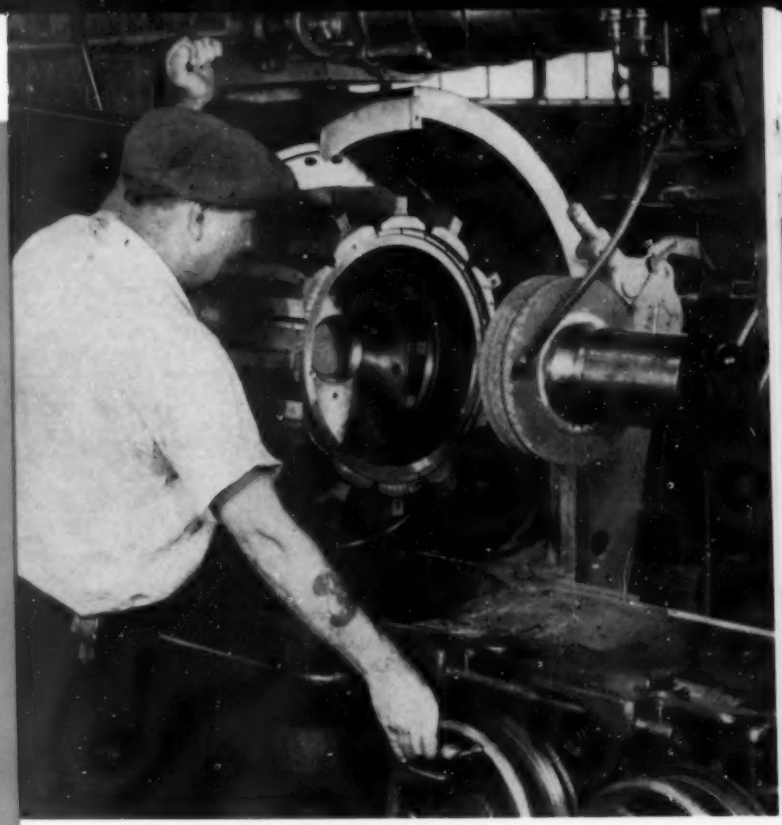


Fig. 1. Precision grinding operation on spacer ring being performed at Kelsey-Hayes Wheel Co. plant typifies many of the precision chucking problems encountered with large, thin wall parts. No distortion is permissible as tolerances are from 0.0005 inch to 0.002 inch.

DEVELOPMENT of the jet aircraft engine has introduced many new and complex problems to the tool engineer. The basic problems involve the need for more than common machining accuracy on a variety of unusual parts. A representative operation is shown in *Fig.* 1. In this instance, the critical processes are the finishing steps, including inspection. The work is further complicated by interrelated requirements of wall thickness, squareness and concentricity of various surfaces. Especially difficult to handle are the many large thin wall sections produced as weldments. Distortion, measured in thousandths, which is likely to be introduced when the parts are placed in a workholding fixture, is sufficient to throw the finished piece out-of-tolerance.

Because of this danger, machining and inspection problems with such parts are complex, more especially since one weldment is usually made of several component parts. For example, a typical welded assembly such as *Fig.* 2, is approximately 30 inches in diameter and several feet long, and has a wall thickness of about 0.125 inch. It contains several machined diameters that must be held to a tolerance of 0.002 inch and to a concentricity within 0.002-inch total indicator reading (TIR). Similar problems are encountered in machining the component details that make up the weldment. The main difference is that the component parts are less rigid before being welded into the assembly.

Requirements for Processing

Two separate sets of conditions govern the processing of these parts. Under one method of handling, the parts may be "out-of-round" in the free state. The theory is that uniformity of wall sections is the prime requisite because the parts will be forced round when assembled into the engine. Under the second condition, the parts must

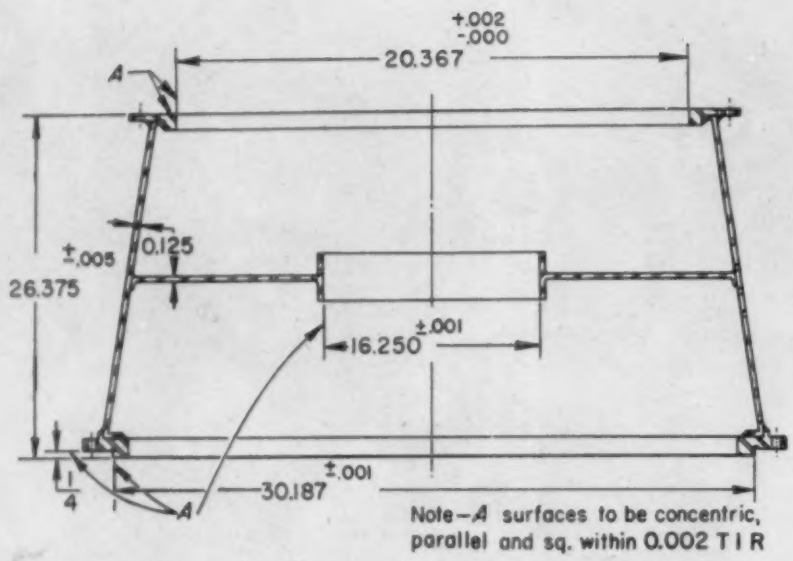


Fig. 2. Typical jet engine weldment. Machining requirements are that the *A* diameters and faces be concentric, square and parallel, as applicable within 0.002-inch TIR, when rounded up in the chucking fixture or assembled in the engine.

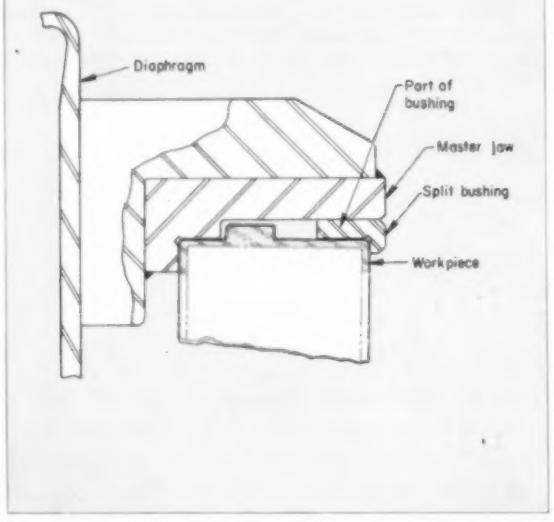


Fig. 3. Sketch of work-holding arrangement for job shown in *Fig* 1. The surrounding jaw is relieved at the corners of the part. The split bushing, slotted alternately from each end, is placed on the part before chucking.

be inspected in the "free state" and must be round within specified tolerances. The latter condition is the more difficult of the two.

Because of these requirements special precision tooling is needed to enable manufacturers to produce jet engine parts on a production basis. The method of work holding is especially critical. Though numerous changes were necessitated in the basic design, to handle this large type of work, the diaphragm chuck principle proved adaptable to this application.

Diaphragm Chuck Principle

Work-holding devices of the diaphragm type use the familiar oilcan action in a spring steel chamber, or diaphragm, in the foundation. With the assistance of a built-in air cylinder, or through mechanical means such as a push-bar, chucking jaws are opened to permit the part to be loaded. Then the force is released and the inherent strength of the diaphragm material securely holds the part throughout the machining operation.

By means of controlled flexing force of spring steel it is possible to chuck parts as large as four-foot diameter shroud rings for jet engines. The amount of chucking pressure used to grip the part is accurately controlled by means of a differential air-control system. This device is a self-contained unit which is adjustable to suit varying conditions and is operated by a single valve. The controls can be preset and the unit locked so that operator tampering is precluded. By use of this unit any pressure ranging from zero to several tons can be applied thru the diaphragm chuck to the part.

The chuck built for the grinding operation shown in *Fig.* 1, has 12 surrounding type jaws and is air-operated. In precision grinding the two inter-flange diameters of this 18-inch diameter spacer ring, it not only was necessary to work to a size tolerance of plus or minus 0.0005 inch, but the concentricity of the ID had to be within 0.002 TIR of the OD. The problem is to locate the piece

part on the two extreme ends where the part is the most rigid, allowing the larger central diameter of the part to pass through the forward section of the chuck jaw. This was accomplished by means of a precision split bushing. The ID and OD of the bushing are ground in the same setting before slotting. In this way the two diameters of the bushing are perfectly concentric so that after slotting, even with distortion in use, the end result is still the uniform wall section vital to this application.

In operation the bushing is pushed over the part before it is entered into the chuck. The split bushing, after slotting, is quite flexible and readily conforms to the piece part. With the bushing on the part they are loaded in the jaw as shown in *Fig.* 3. After loading, the air pressure on the diaphragm is released; it tries to return to its original position and in so doing causes the jaws to decrease in diameter, securely chucking the part. On such a job the chucking error is held to less than one third the part tolerance. The part is securely chucked without distortion; and loading and unloading time is a small factor in the over-all cycle time.

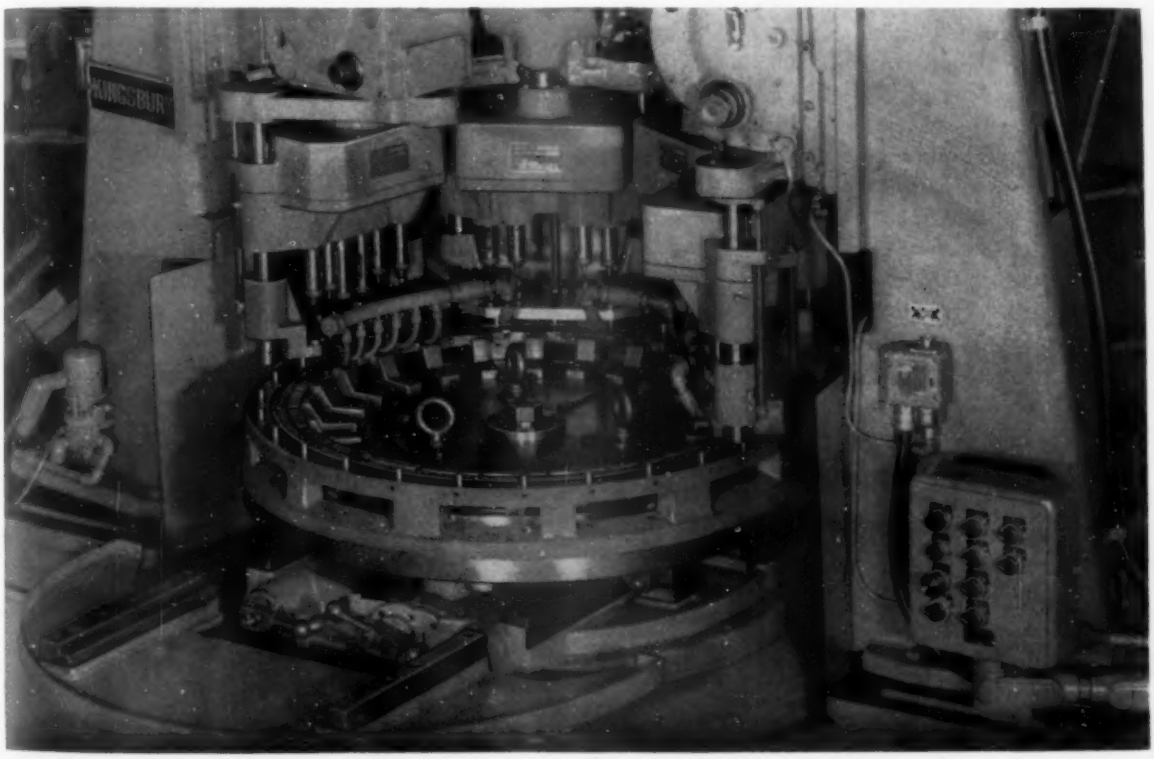
Out-of-Round Condition

If the part can be out-of-round in the free state the processing and tooling are somewhat simplified. By using a diaphragm chuck and surrounding jaws to completely enclose the part, the part is assured of being rounded up to assume its eventual assembled condition. In this position it can then readily be machined. If the part is out-of-round when it comes to the chuck, it will return to this condition after removal. The results will be that although the part is out-of-round in the free state the wall section will be uniform and the concentricity excellent. This insures that the part as assembled into the jet engine is forced round so it will properly serve its function.

Since the other condition, round in the free state, is more critical in tooling, a general recommendation is that in the early stages of manufacturing there be incorporated an operation to machine a round internal diameter or external diameter for future machining purposes. This can best be accomplished by end clamping, while an internal or external diameter is machined. The advantage of end clamping is that it avoids distortion of the wall section. Once a true (round) diameter is established, it can be chucked with sufficient pressure for any machining operation without workpiece distortion. The only requirement is that either the internal diameter must be completely filled or the outside diameter fully surrounded while machining.

Another condition that sometimes occurs is that in applying enough pressure to hold the part for machining, the part is actually temporarily decreased or increased in diameter. Depending upon whether the part is externally or internally chucked, it is a simple matter to compensate for this con-

Fig. 4. Special 36-inch diaphragm chuck locates a 30-inch diameter part on center for drilling 108 small holes. Tests show the chuck repeats within the 0.0005-in. TIR required for interchangeability of parts.



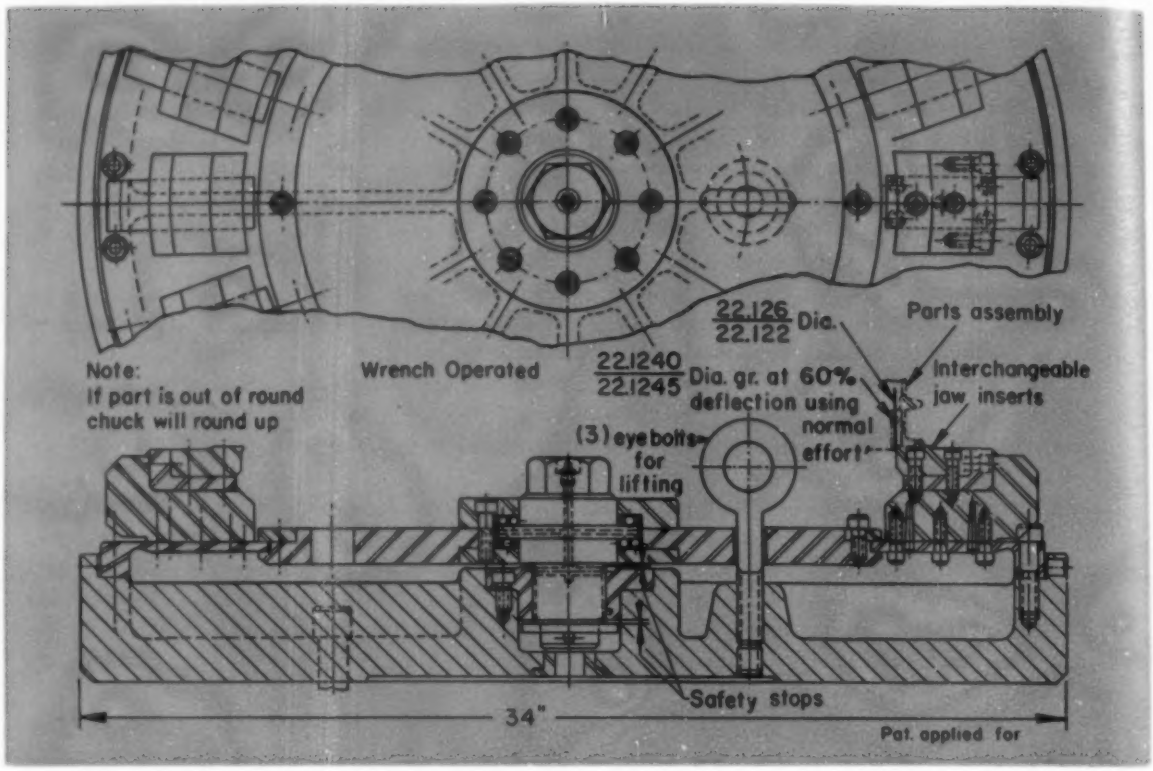


Fig. 5. Wrench operated inspection chuck holds workpiece in assembly condition for inspection. Assembly configuration is shown at upper right of front section.

dition. *Fig.* 4 shows a 36-inch diameter ring being held by diaphragm chuck on a Kingsbury special drilling machine. The operation being performed is drilling a large number of holes in the ring. All holes must be concentric within 0.002 inch to the outside diameter. Inspection shows the holes to be concentric with the OD within 0.0005-inch TIR.

The specially designed 34-inch diameter wrench-operated diaphragm chuck shown in *Fig.* 5 is used for inspection purposes. The chuck locates the part on center and rounds it up. This is a simulated assembly condition. The chuck itself is mounted to a special universal type rotary fixture that will tilt to any desired angle. With the part thus located final inspection of the part is performed. The chuck is designed for interchangeable jaw inserts to suit various parts and will repeat within less than 0.0005-inch TIR.

Variety of Applications

This type of equipment is versatile, and its cost is justified when its advantages are tabulated. As an example, if the part is changed it is relatively simple either to rework the jaw inserts or replace them. The entire fixture does not have to be replaced or scrapped as is sometimes the case in conventional fixture designs. Also the jaw inserts can be replaced to accommodate other similar parts. Thus, one basic diaphragm chuck can be adapted to various conditions and will accept many parts, giving a durable fixture incorporating maximum accuracy.

Continuing accuracy is insured in this type of design by the elimination of as many moving parts as possible. There are no mating tapers or sliding fits to become worn. The metal itself does the flexing and because the elastic limit of the steel is never closely approached, the diaphragm will last indefinitely.

The large diameter air-operated diaphragm chuck, shown in *Fig.* 6, represents another of these difficult holding problems. The chuck is designed with 24 hard surrounding jaws. Various diaphragm assemblies can be interchanged to suit different parts. The chuck is designed in such a way that it can be used for either internal or external chucking, depending on the type of diaphragm assembly. Eye bolts are provided for lifting purposes to aid in handling the chuck. This chuck was designed for inspection use, but can also be used for machining, grinding or other finishing operations.

These same basic problems and solutions are also applicable to small diameter parts. *Fig.* 7 shows a 7-inch diaphragm chuck used on a precision boring machine. The operation is to bore this small diameter bearing liner concentric to the OD within 0.0005-inch TIR. Again the basic principle of surrounding the part is applied. If the part is out-of-

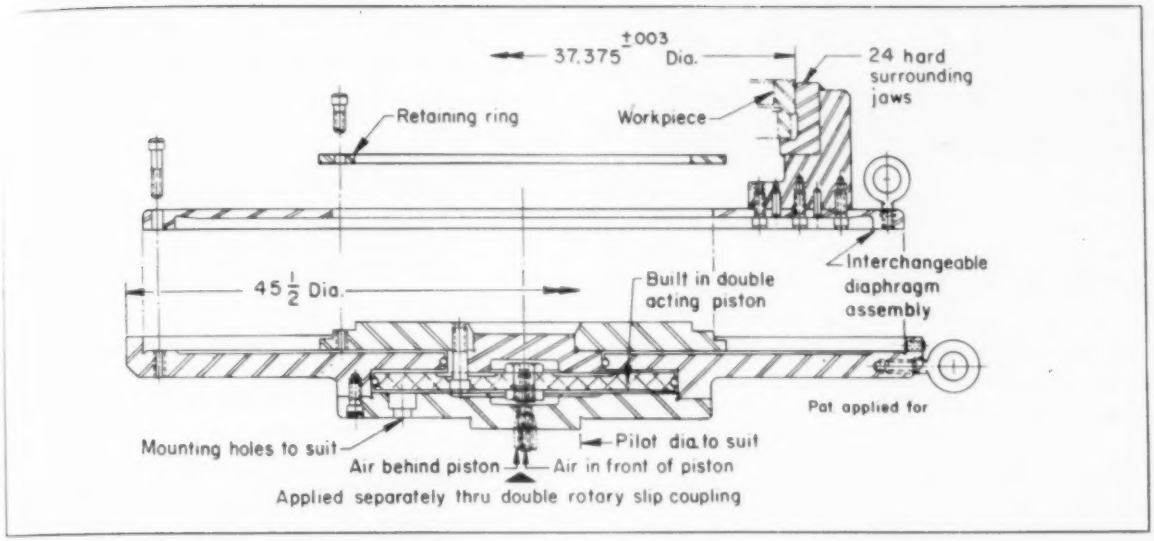


Fig. 6. By means of a double rotary slip coupling, this chuck can be used for both internal and external chucking. The above exploded view of the 45½-inch diameter fixture indicates that the diaphragm is a separate interchangeable unit.

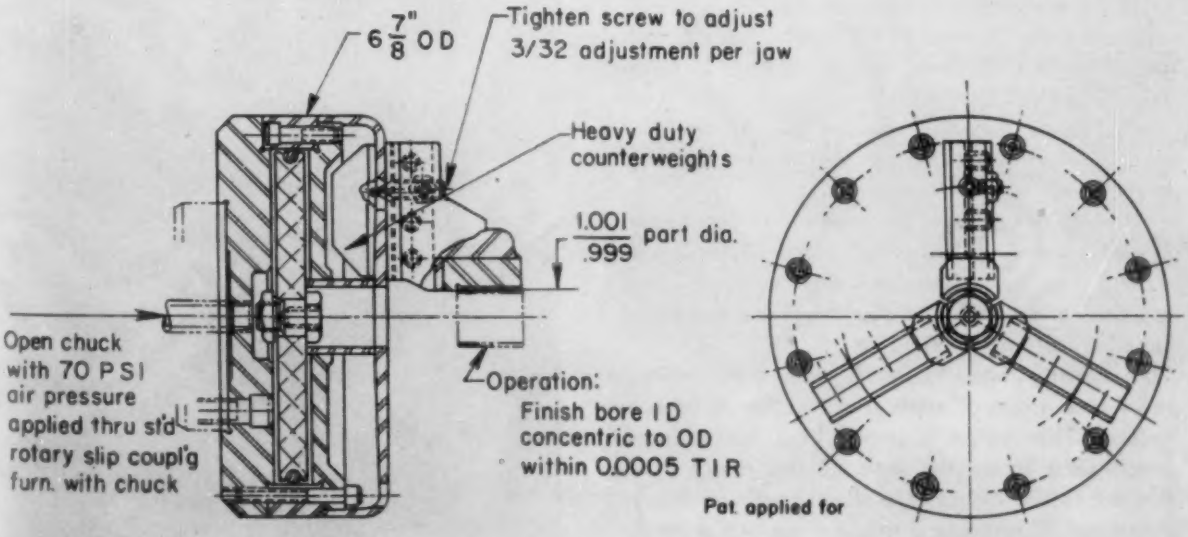
round, the chuck will round it up, insuring uniform wall thickness. If the part is round as it comes to the chuck, it will remain so after the operation is performed. In either case the concentricity of ID to OD will be well within the specified 0.0005-inch tolerance.

As a general rule of thumb, these chucks give one-third the locating diameter tolerance for concentricity. Thus, if a diameter is held to a 0.001-inch tolerance, a concentricity of 0.0003-inch TIR is provided in the chuck.

Study Applications

As indicated by the foregoing examples, each precision production application requires a study of the special conditions involved. New demands have resulted in new answers such as special surrounding type jaws, floating jaws and the like. Thus, proved methods of work holding can usually be adapted to the situation by careful design and integration of the various elements.

Fig. 7. Another problem was introduced with this chuck because the work rotates at a high rpm. Special counterweights are used to prevent centrifugal force from opening the chuck jaws and the chuck is dynamically balanced.



Gadgets

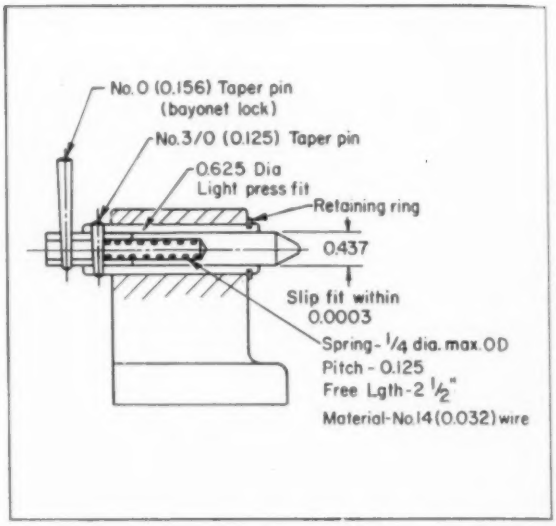
Ingenious Devices And Ideas To Help The Tool Engineer In His Daily Work

Jet Blade Tip Center

The live center shown in the accompanying drawing was designed for holding jet engine blades at the tip end with maximum bearing for minimum length. The bayonet lock is optional for holding the center back under certain loading conditions. In most cases a simple slot suffices. Contrary to the experience with many types of short centers, this one has proved accurate over long periods of time.

A few drops of machine oil can be applied to eliminate any tendency for the center to bind. This design can be adapted to many applications on work and inspection fixtures. It can be scaled up or down to suit conditions.

George Hooey
Bronte, Ont.



Rotary Die Vise

Conventional vises formerly were used to secure dies and parts while hydropressure wrinkles were ironed out with mallets and lead bars. Dies normally are placed back-to-back so opposite parts can be smoothed uniformly. When a conventional vise was used, every time hand-forming was completed on one set of parts, the vise had to be opened, dies and parts removed, and dies and new parts inserted.

The operator had to support the dies while he changed their positions in the vise to reach flanges on all sides. Since these dies weigh from 15 to 30 pounds per set, it was fatiguing to lift them from vise to bench some 200 times a day. If dropped, serious injury could result as well as costly damage to the dies.

The rotary type vise pictured, developed in the machine forming department at the Temco Aircraft Corp. has eliminated this safety hazard, speeded hand-forming by 25 percent and simplified handling of heavy dies.

It consists, first, of a mount, formed by welding two 4-inch pieces of angle iron together to form a square. This mount, clamped in a conventional bench vise, forms the base of the rotary vise. Welded to the mount is a short length of 2-inch ID tubing. This tubing is split and encloses a 9-inch length of 2-inch diameter bar stock. The split tub-

g can be tightened round the bar stock by means a T-type friction clamp.

Welded and pinned to one end of the bar stock a ½-inch angle iron positioning post which rves as one jaw of the rotary vise. Dies and arts rest on a ⅜-inch plate steel platform, welded t 90 degrees to the bottom of the positioning post. Dies are secured by a fixture clamp which is welded to platform and post, but they also are supported by the steel platform. Heavier dies can be bolted to the rotary vise—one die secured to the vertical post, the opposite die bolted to the disk-type jaw on the clamp. Thus, it is unnecessary to remove or steady the dies, when vise pressure is relaxed to remove finished parts and insert new ones.

Also, the platform and post, which revolve on the length of bar stock enclosed in the split tubing, have a travel of 360 degrees. The operator simply revolves the vise to the best angle for smoothing a particular flange and secures it there by tightening the T-clamp on the split tubing. Several rotary vises of different sizes have been made as needed.

J. H. Simpson
Grand Prairie, Texas

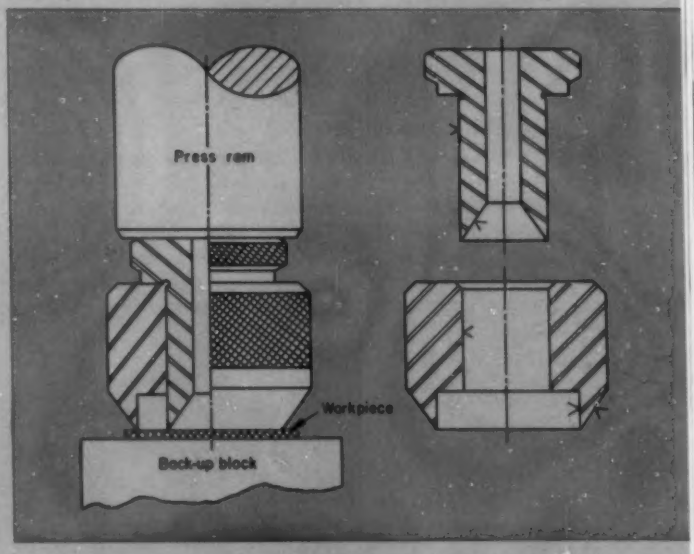
Punch for Thin Washers

Small quantities of fiber thrust washers and aluminum grease throw rings were needed from time to time. These had previously been made by turning them on the lathe from sheet or tube stock. This method was unsatisfactory from the standpoint of time and quality. Conventional punches and dies for the punch press would have been too costly due to the variety of sizes and the small quantities desired. The illustrated double punch was devised and built for several sizes of fiber washers. It proved so successful that similar punches were made for the aluminum throw rings. These have been equally successful.

The two-piece punch is made from a good die steel hardened and drawn to approximately 56-58 Rockwell C. The parts are ground on the surfaces indicated. They can be used in either a hand or hydraulic arbor press. The work and punches are seated on a block of hard maple. A piece of thick, soft, aluminum plate will also do for the backup block if care is used in building these punches so that the cutting edges of both the inner and outer punch are on the same plane when assembled. The metal backup is desirable for punching aluminum washers as there is less deformation and a cleaner edge is secured on the finished part.

Approximately 30 degrees included angle is satisfactory for cutting the fiber washers but this angle must be increased to 40-45 degrees for the harder aluminum alloys. The smaller angle tends to chip after some usage on this metal.

When the punches are dull they may be reground on the angular surfaces and their effective sizes will not be altered. The tool is, of course, limited insofar as thickness of material it will cut. Up to 3/32-inch fiber has been cut but only up to 14-gage (0.064-inch) aluminum sheet. The operation is also rather slow: it is necessary to pull each completed washer from the outer punch and occasionally an aluminum slug will stick in the conical part



of the inner punch and must be pushed out. For small quantities, however, this small nuisance is easily offset by the great saving in tooling.

H. J. Gerber
Member-at-large
Stillwater, Okla.

Stiffening Small Punches

Small punches for piercing rather heavy stock must be designed with care to be able to resist the stresses imposed on them. Not only is compressive stress involved, but buckling tendencies are also present in punches of small diameter and comparatively great height. Trouble begins when the ratio

between length and diameter exceeds five to one. Round punches are considered first since the majority are of this kind.

Some means of stiffening the punch must be provided: (1) when the diameter of the hole to be pierced is less than 0.1 inch regardless of stock shear strength, or (2) when the ratio between hole diameter and stock thickness is less than 1.5 to 1 for low shear strength and 2 to 1 for high shear strength stock. Stiffening can be done by increasing body size or adding a supporting quill.

The first solution consists in designing a punch with a greater body and a short cutting point. The usual proportions are given in design *1* of the accompanying illustration. Of course this design requires more steel than the original, needle type punch. This may be compensated by a subdivided, sectional, composite construction, as in *2*. The original punch is enclosed in a stiffening tube.

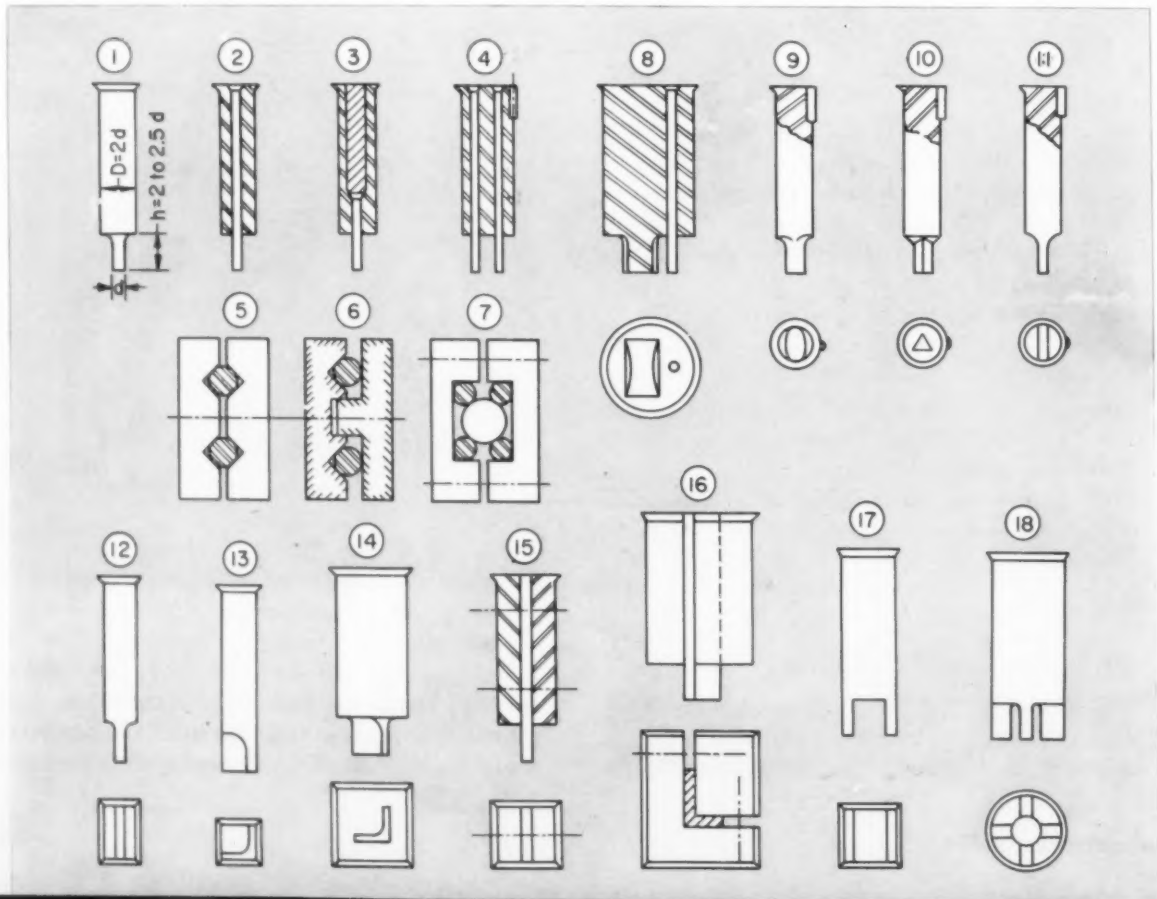
With this design the punch is made of high-carbon alloy steel, while the quill is made of inexpensive low-carbon steel and hardened. This design may be further refined by shortening the actual cutting punch, using a filler of hardened drill rod, design *3*. This type affords three further advantages apart from reduced cost: first, drilling the punch hole in the quill is easier since it is shorter; second, accuracy of the filler hole is not critical, and third, the shorter punch results in less trouble from buckling.

When two small, round punches are located too close together for two quills to be used, a common quill may be employed, design *4*. In such cases some means must be provided to prevent the quill from turning, which would have disastrous consequences. Pins, setscrews and milled surfaces are used. Two such adjacent punches may be held in sectioned quills with vise or fixture jaws, designs *5*, *6* and *7*. The jaws are held together with screws or bolts. Sometimes if a small, round punch is located near a large one, they may be incorporated in one body, design *8*.

Small punches for piercing noncircular holes, may be reinforced in some other ways. Whenever possible, the body should have a round section with only the actual cutting point shaped to the hole contour. Designs *9*, *10* and *11* are typical examples. Again, the punches must be secured to avoid turning.

When the cutting shape makes a round body inconvenient it should be square or rectangular, designs *12*, *13* and *14*. While noncircular punches may be supported by quills, such auxiliary means are commonly the sectional type as in characteristic examples *15* and *16*. Closely located noncircular punches may also be reinforced by uniting them in a common body. In *17* two small parallel slotting punches are held in a square body and in design *18* four radially located slotting punches are joined in a round body.

Frederico Strasser
Santiago, Chile



sampling plans

reduce inspection time

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THE PRIMARY REASON for inspecting samples rather than entire lots is the large savings that can be effected in inspection time. Because 100-percent inspection can introduce fatigue or lack of attention factors inspection of samples is frequently more accurate. Also, 100-percent inspection is impossible when testing to destruction. When properly applied, a sampling plan is designed so its error is known.

Sampling plans are of two types, namely, for inspection by attributes, *Fig.* 1, and for inspection by variables. The established terminology includes the following terms:

Lot Size—Number of parts in the shipment.
Acceptable Quality Level (AQL)—Lowest desired lot quality.
Sample Size—Number of pieces drawn from a lot for inspection to determine the quality of the whole lot.
Acceptance Number—Maximum number of defective pieces in the sample if the lot is to be accepted on the basis of the sample.
Average Outgoing Quality Limit (AOQL)—Maximum percentage of defective parts that can consistently exist in the outgoing product.

Under ideal conditions, all lots of acceptable quality would be accepted and all of those outside this category would be rejected. For example, if the acceptable quality level were 25 percent defective, then all of those lots equal to or better than this would be accepted and all others rejected. Since the decision is based on a sample, there is a possibility that the sample will not be entirely representative of the lot from which it was taken. Thus, there is an area of error in which some lots will be accepted that should be rejected and some rejected that should be accepted.

An actual curve of a typical sampling plan is shown in *Fig.* 2. A curve of this sort is known as the operating characteristic (OC) curve and its form depends on the lot size, percent defective, sample size and acceptance number. The various points on the OC curve are referred to by special terms as follows:

Quality level (P_0) is the AQL.
Quality level (P_1) is the poorest quality that would be willingly accepted any of the time. It is known as the lot tolerance percent defective. (LTPD).
Producers Risk: For any AQL there is a risk (α) which is the probability of rejecting a lot with quality P_0. It is a measure of the risk of a good lot being rejected.
Consumers Risk: For every LTPD there is a (β) risk which is the probability of accepting a lot with quality P_1. It is the measure of the risk that a bad lot will be accepted.

In a practical situation, the P_0 (AQL), P_1 (LTPD) and the α and β risks must be specified, so that a sampling plan can be devised accordingly.

The OC curve shown in *Fig.* 2 is for a sampling plan with a sample size of 50 and an acceptance number of 4. For an AQL of 4 percent the producer's risk is 10 percent and for an LTPD of 16 percent the consumer's risk is 5 percent. Assume an AQL of 4 percent and an LTPD of 16 percent as indicated by P_0 and P_1 respectively in *Fig.* 2. Then if a lot which is only 2 percent defective is inspected, there is a 5-percent probability that this desirable lot of parts will be rejected. If a lot which is 10 percent defective is inspected, there is a 35-percent probability that this lot will be accepted and a 65-percent probability that it will be rejected.

This example emphasizes that any sampling plan

inherently has some error. Since under a well-designed sampling plan these risks are known, they are taken into consideration. With 100-percent inspection and fixed-percentage rule-of-thumb sampling plans similar errors occur, but they are unknown values which result in misleading quality levels and misinterpretations of data.

To select an appropriate sampling plan it is necessary to consider such factors as how critical the part is, its cost, cost of inspection and cost of eliminating rejects later in the process. Sampling plans are based on two general approaches: those that assume rejected lots will not be screened (Mil-Std-105A)[1] and those that minimize over-all inspection by sampling and 100-percent screening of rejected lots (Dodge Romig Sampling Tables).[2]

The use of attributes sampling plans has been greatly encouraged by various bureaus of the U. S. Government. For this reason, sampling tables included in Mil-Std-105A, *Fig.* 3, have the widest appeal in industry. Use of this standard greatly simplifies selection of an appropriate sampling plan for a particular application, since it is only necessary to know the lot size and the AQL. Instead of allowing for adjustment in the alpha and beta risks, letters of the alphabet to lot size and inspection levels, *Fig.* 3, and a master sampling plan, *Fig.* 4.

The following example typifies the procedure for using a sampling plan from Mil-Std-105A, in which a lot will be accepted or rejected on the basis of a single sample. Based on a record for 10,000 parts, an acceptable Quality level (AQL) of 1 percent is desired. For these conditions the lower limit is 0.70 and the upper limit is 1.30. The process is classified for normal inspection since it falls between the lower limit of 0.70 and upper limit of 1.30. Assuming the parts are in lots of 1000 for inspection level II, the sample size code letter is K. For sample size code letter K, AQL 1 percent and normal inspection, the sample size (n) is 110, the acceptance number is 3 and the rejection number is 4, *Fig.* 4. Therefore, 110 parts in the lot of 1000 would be inspected. If 3 or less rejects were found, the lot would be accepted; if 4 or more, rejected.

When the process average of a part is especially good, or bad, it is advantageous to use a double sampling plan. A double sampling plan is a plan where it is necessary to take two samples before reaching a decision as to whether or not a lot is acceptable. Multiple sampling plans in which more than two samples may be required for a decision, do not find wide application because of administrative difficulties.

Fig. 1. Parts arrive in lots in this receiving department and are inspected on an attributes sampling plan.

the Government tables make provision for three inspection levels and also "tightened, normal and reduced" inspection.

In the usual application, inspection level II is used. In order to know whether normal, tightened or reduced inspection is applicable, the process average, or the average percent defective history for the part, must be known.

A part of Mil-Std-105A, is a code which assigns

A classification of defects, such as used with c charts, can also be applied to sampling inspection. When this is done, the different classifications are inspected to different AQL's so that, in effect, the amount of inspection performed is based on the importance of the defects. This system frequently so complicates the use of sampling tables that they lose their practical value. For this reason, the

1 References are tabulated at end of article.

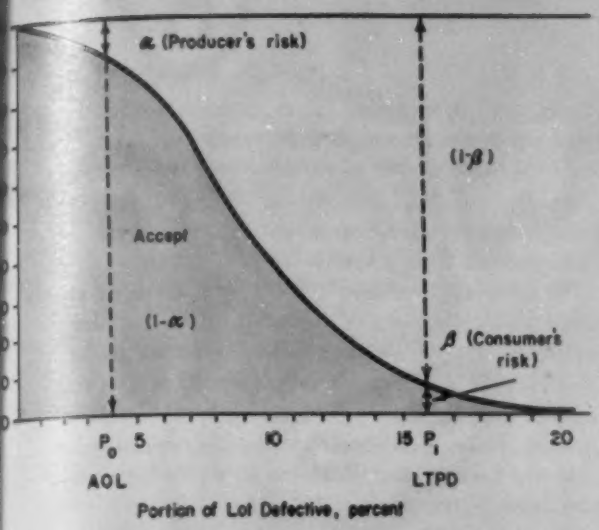


Fig. 2. Actual operating characteristic curve. This indicates that if P_0 is the acceptable quality level, lots of such quality will be accepted most of the time and rejected alpha (α) percent of the time. Lots of the worst acceptable quality P_1 will be rejected most of the time but will be accepted beta (β) percent of the time.

classification of defects with sampling tables is uncommon.

Sampling plans are based on the assumption that each part in a lot has an equal opportunity of being selected as part of the sample. This condition is referred to as randomness. Parts selected from a lot which are to be inspected under sampling plans must be chosen by chance; no bias should be introduced by the inspector taking the sample.

When using an attributes sampling plan a decision must be reached as to the disposition of rejected lots. If rejected lots are screened, then the AOQL (average outgoing quality limit) is of interest. Since this is true in many applications, sampling plans which are tabulated by AOQL are becoming more popular. The outstanding source of these is Dodge and Romig.[2]

While attributes sampling plans, as described, are ideally suited for inspection in receiving departments, in production departments the inspection or the final buy-off would have to be delayed until the production run was completed.

Also such sampling plans are not applicable to the system of roving inspectors. To overcome the problem of tying up lots pending final acceptance and to integrate the use of sampling plans with the roving inspector system, a procedure has been devised whereby the samples are taken while the work is in progress. The procedure draws a partial sample in such a way that the total sample, as called for by the sampling plan, is completed at the same time that the production run is finished.

To apply this procedure a form, *Fig.* 5, has been devised. In the B portion of the form are entered such data as the acceptable quality level, lot size,

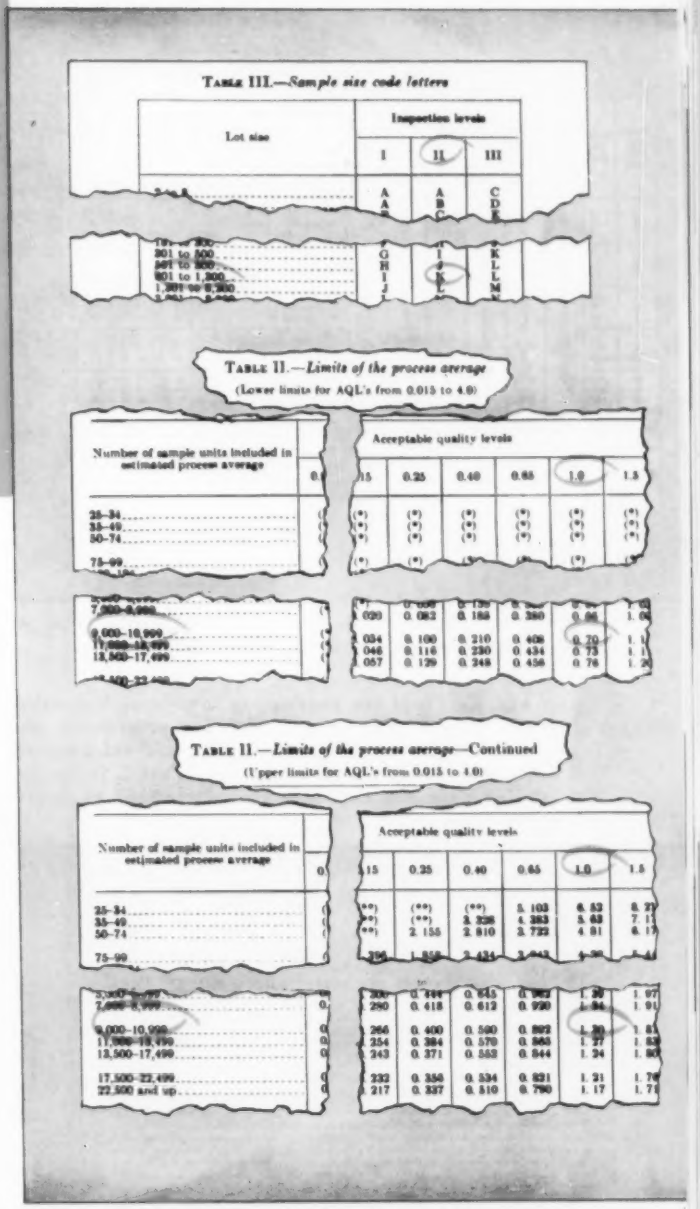


TABLE III.—*Sample size code letters*

Lot size	Inspection levels		
	I	II	III
2 to 8	A	A	C
	A	B	D
	A	C	E
281 to 500	G	I	K
501 to 800	H	J	L
801 to 1,300	I	K	M
1,301 to 2,000	J	L	N

TABLE II.—*Limits of the process average*
(Lower limits for AQL's from 0.015 to 4.0)

Number of sample units included in estimated process average	Acceptable quality levels					
	0.15	0.25	0.40	0.65	1.0	1.5
25–34	(*)	(*)	(*)	(*)	(*)	(*)
35–49	(*)	(*)	(*)	(*)	(*)	(*)
50–74	(*)	(*)	(*)	(*)	(*)	(*)
75–99	(*)	(*)			(*)	
7,500–9,999	0.020	0.082	0.188	0.380	0.66	1.06
9,000–10,999	0.034	0.100	0.210	0.408	0.70	1.1
11,000–13,499	0.046	0.116	0.230	0.434	0.73	1.1
13,500–17,499	0.057	0.129	0.248	0.456	0.76	1.2

TABLE II.—*Limits of the process average*—Continued
(Upper limits for AQL's from 0.015 to 4.0)

Number of sample units included in estimated process average	Acceptable quality levels					
	0.15	0.25	0.40	0.65	1.0	1.5
25–34	(**)	(**)	(**)	5.103	6.53	8.27
35–49	(**)	(**)	3.226	4.383	5.63	7.13
50–74	(**)	2.155	2.810	3.722	4.81	6.13
75–99		1.859	2.424	3.243	4.20	5.44
7,500–9,999	0.284	0.494	0.845	0.962	1.20	1.97
9,000–10,999	0.280	0.418	0.612	0.920	1.04	1.91
11,000–13,499	0.266	0.400	0.590	0.892	1.20	1.85
13,500–17,499	0.254	0.384	0.570	0.865	1.27	1.82
17,500–22,499	0.243	0.371	0.553	0.844	1.24	1.80
22,500 and up	0.232	0.356	0.534	0.821	1.21	1.76
	0.217	0.337	0.510	0.790	1.17	1.71

Fig. 3. Portions of tables showing limits of the process average and code for sample size, from Mil-Std-105A. Use is explained in the text by the example.

sample size and rejection number. The subsample size is the sample size as called out by the sampling plan, divided by the number of inspection periods. The inspection interval indicates whether this subsample will be taken at one time, on an hourly basis, or some fraction. In general, the entire subsample being taken on an hourly basis seems to be the most practical method.

As each sample is drawn, the time is entered in the T space, part C. For each part inspected, the inspector places a mark in the "In" box if all dimensions or characteristics are acceptable. An unacceptable dimension or characteristic is noted in the "Dimension Out" space. At the end of the run, the number of marks in the "Out" box are tallied

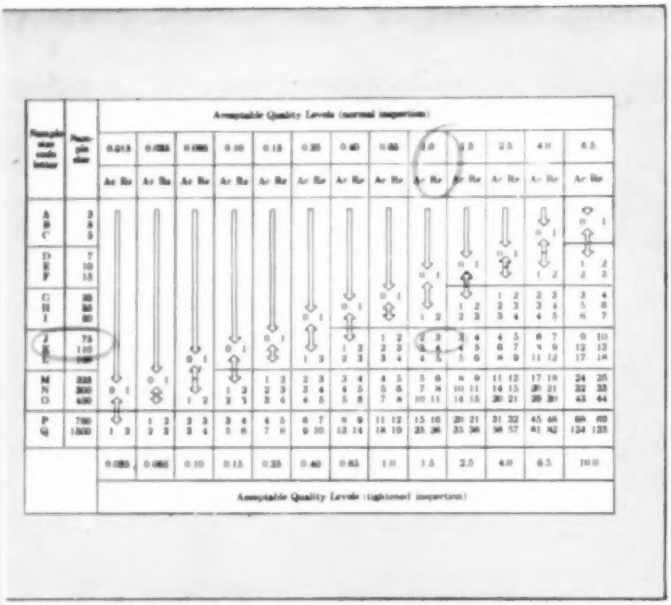
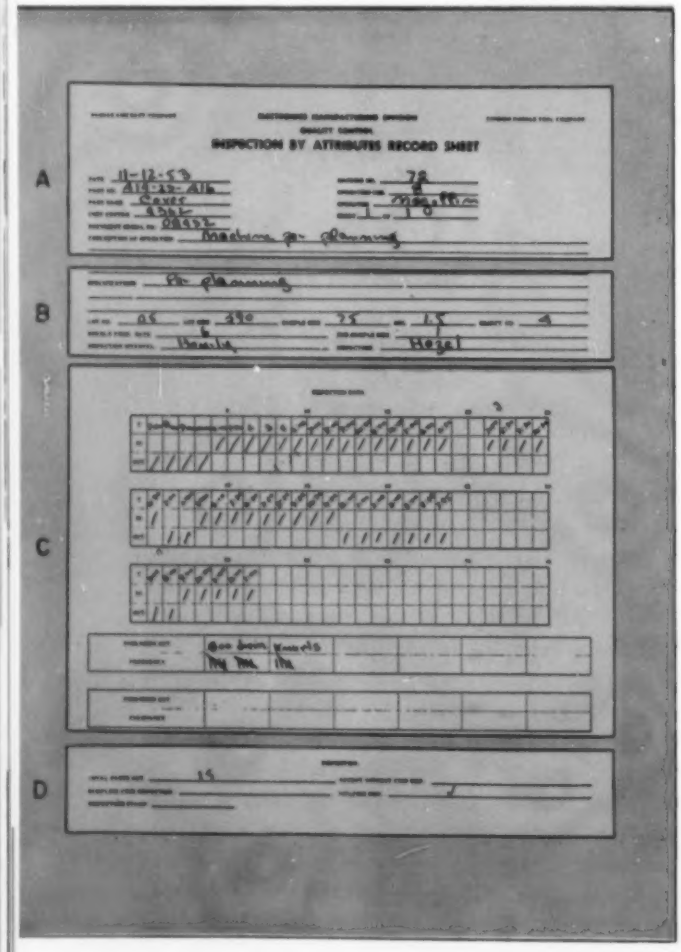


Fig. 4. Master table for normal and tightened inspection, single sampling, from Mil-Std-105A.

Fig. 5. Form for conducting in-process inspection by attributes. Part A provides for procedural and identifying information; Part B gives information regarding the sampling plan used; Part C is for recording data and Part D is for conclusions as to disposition of lot.



and entered on the form as shown in the "Total Parts Out" space, part D. A decision on the disposition of the lot can then be made.

If the total number of parts is equal to, or greater than, the rejection number for the sampling plan being used, then the disposition of the lot should be "100-percent Crib Inspection."

In some applications, a procedure has been applied where the form is instituted by the machinist setting up the job in advance of the actual production run. This adaptation saves inspection time and enables the inspector to perform his actual function. In such a case it is necessary that the machinist be able to complete part B of the form, including lot size, sample size, etc.

In those plants where the machinist has been indoctrinated with some of the reasoning behind sampling plans, this system has been applied successfully, with the bulk of the sampling actually being done by the machinist while the inspection department oversees the program. Production personnel must be properly educated in the philosophy of the system; otherwise it is difficult to get them to report rejects as required.

In-process inspection by attributes sampling plans has the advantage of being applicable to complex parts regardless of the number of dimensions or characteristics being inspected. Only one form is required for each part. It is frequently advantageous, however, to maintain an $\overline{X}$ and R control chart also for those dimensions or characteristics which are most critical and indicative of the acceptability of the final part.

Although sampling plans based on inspection by attributes cover the bulk of problems encountered, there are advantages in performing inspection by variables and basing sampling plans on such data. These advantages of a variable sampling plan would include the following:

1. For the same protection against accepting a bad lot or rejecting a good lot, the sample size required for variable sampling plans is smaller than that required for attributes sampling plans.
2. Inspection by variables provides more information than does inspection based simply on a "go not-go" basis.
3. The reduced sample size is especially advantageous where inspection is costly, time consuming, or destructive.
4. The problem of determining the quality of borderline lots is reduced since actual measurements are recorded rather than simply classifying a part as good or bad.
5. The amount that a part is within or outside of the specification is taken into consideration and therefore vendor rating can be done more accurately.

The disadvantages of a variable sampling plan are as follows:

such a plan is somewhat difficult to administer because of the calculations necessary. This has been somewhat overcome by the tabulation of the plans in a manner similar to that used in Mil-Std-105A and certain graphical presentations such as Lot Plot.

In using such a plan, it is assumed that the frequency distribution of the parts can be represented by a normal, or near normal, curve. Although this assumption is a reasonable one, in some cases it may result in misleading conclusions.

Unlike attributes sampling plans, a variable sampling plan can be applied to only one characteristic at a time.

As with attributes sampling plans, it would be desirable to have a situation where all lots submitted would be accepted if the percent defective was at a set value or less and rejected if above this value. This is only theoretically possible and in practice, there are, as with attributes sampling plans, producer and consumer risks, as shown by the operating characteristic curve, *Fig.* 2.

Sampling plans for variables have been tabulated in the following two sources: *Sampling Inspection Plans by Variables*, Bowker and Goode[3] and "Naval Ordnance Standard Sampling Procedures and Tables for Inspection by Variables"—NavOrd-80. These two sources have greatly simplified the application of inspection by variables plans.

The Government tables on sampling plans for inspection by variables are not indexed according to producer and consumer risks. To select the appropriate sampling plan from the NavOrd-80, it is only necessary to know the lot size and the acceptable quality level.

In determining whether to apply normal, tightened or reduced inspection, it is necessary to calculate the process quality indexes, which are designated by C'_U for the upper specification limit and C'_L for the lower specification limit. Other factors which must be computed are the lot quality index for the upper specification limit (C_U) and the lot quality index for the lower specification limit (C_L).

$$C'_U = \frac{U - \overline{\overline{X}}}{S} + 10 \qquad C_U = \frac{U - \overline{X}}{S} + 10$$

$$C'_L = \frac{L - \overline{\overline{X}}}{S} + 10 \qquad C_L = \frac{L - \overline{X}}{S} + 10$$

where

L = Lower specification limit

S = Standard deviation of all sample measurement a group of lots

U = Upper specification limit

$\overline{X}$ = Arithmetic mean of the sample measurements for a single lot

$\overline{\overline{X}}$ = Average of all of the parts inspected from the process

The steps that are required in order to apply one of the sampling plans are shown in *Fig.* 6. Although the computations appear to be complex, if the steps are followed in accordance with the flow chart, the procedure will fall into a relatively simple pattern.

Following through the procedure of applying an

Fig. 6. Flow chart for operation of single sampling plan for inspection by variables. NovOrd standard deviation symbol (*S*) is equivalent to commonly used symbol sigma (σ).

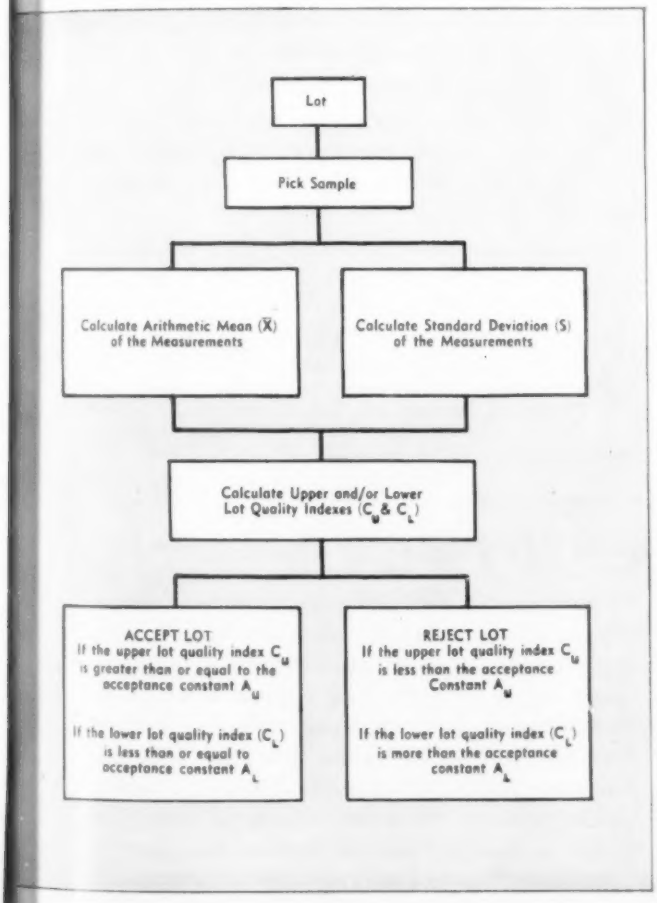
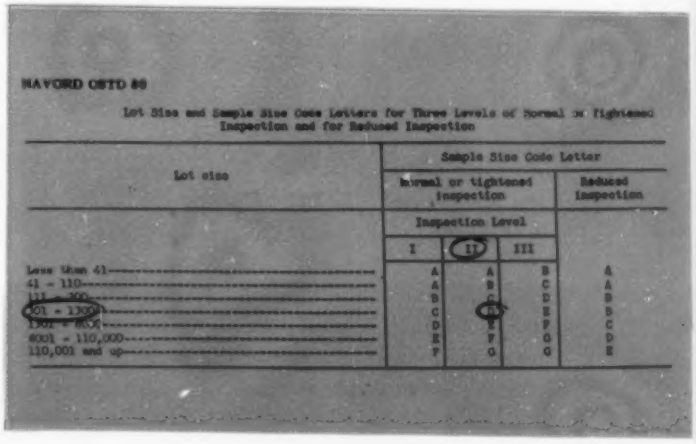


Fig. 7. Typical page from NavOrd-80 giving coding of samples.


NAVORD OSTD 80

Lot Size and Sample Size Code Letters for Three Levels of Normal or Tightened Inspection and for Reduced Inspection

Lot size	Sample Size Code Letter			
	Normal or tightened inspection			Reduced inspection
	Inspection Level			
	I	II	III	
Less than 41	A	A	B	A
41 - 110	A	B	C	A
111 - 300	B	C	D	B
301 - 1300	C	D	E	B
1301 - 3200	D	E	F	C
3201 - 110,000	E	F	G	D
110,001 and up	F	G	G	E

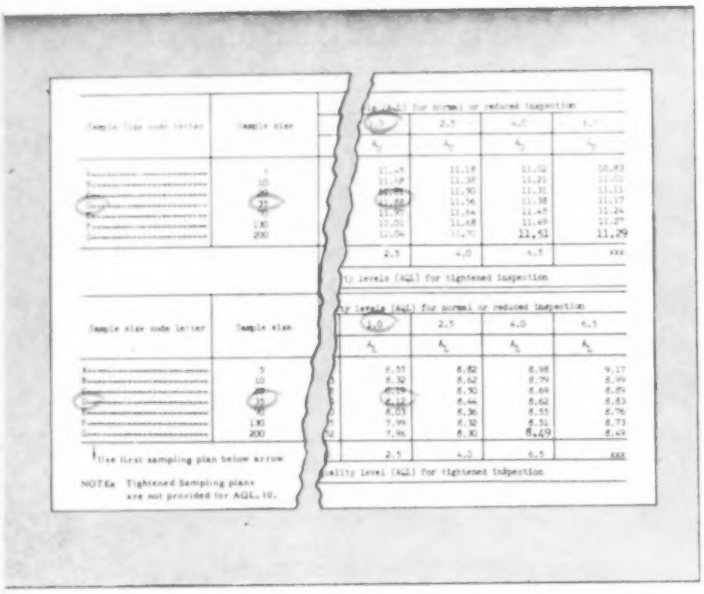


Fig. 8. Master sampling table for upper and lower specification limits for normal, tightened or reduced inspection. Sample size and acceptance constants are for single lot decision, variables sampling plans.

inspection by variables sampling plan from NavOrd-80: let it be assumed that the records indicate the process quality indexes for the part to be inspected are $C_U = 12.4$ and $C'_L = 7.7$ Also, that these two values are based on a series of samples totalling 1,000 parts. An acceptable quality level of 1 percent is desired.

For the quality index values, based on 1,000 parts, and an AQL of 1 percent, and since neither tightened nor reduced inspection is called out for the parts, normal inspection is used. If the part to be inspected is new and there is no past history on it, then it is not possible to calculate C'_U and C'_L so normal inspection is used. After the item has been received for some time and data have been accumulated, the indexes should be calculated to determine if tightened or reduced inspection should be applied.

If the parts are in lots of 1,000 for inspection level II, the sample size code letter for the lot is D, *Fig.* 7.

For code letter D, AQL 1 percent and normal inspection, the sample size is 35, *Fig.* 8. Acceptance constants are: $A_U = 11.88$ and $A_L = 8.12$. Therefore, 35 parts in the lot of 1,000 would be inspected and the measurements recorded. Values for C_U and C_L must be computed. If the lot quality index C_U is greater than or equal to the acceptance constant A_U the lot may be accepted for the upper specification limit. If the lot quality index C_L is less than or equal to the acceptance constant A_L then the lot may be accepted for the lower specification limit. The master sampling table, *Fig.* 8, is also used for tightened inspection by reading the acceptance quality level values along the bottom of the table.

The discussion so far has been limited to single sampling plans which operate as shown in *Fig.* 6. Double sampling plans for inspection by variables are available and are described in *Sampling Inspection Plans by Variables*, Bowker & Goode. However, because of the difficulty of administration of such programs, and the complexity of the mathematics involved, such plans do not find wide acceptance at this time.

In an attempt to simplify the mathematical basis of sampling inspection plans by variables, various techniques have been developed where the data are represented graphically and decisions reached visually. The most widely accepted of these techniques is that developed by Dorian Shanin, normally referred to as Lot Plot.[4] Although Lot Plot has found some acceptance, it is still too soon to indicate that the results are reliable.

References

1. Military Standard 105A—*Sampling Procedures and Tables for Inspection by Attributes*, 11 September 1950.
2. *Single and Double Sampling Inspection Tables*—Dodge, H. F. and Romig, H. G., J. Wiley & Sons, Inc., New York, 1944.
3. *Sampling Inspection Plans by Variables*, Bowker and Goode, McGraw-Hill Book Co., New York.
4. "Hamilton Standard Lot Plot Method of Acceptance Sampling by Variables," by Dorian Shanin, *Industrial Quality Control*, July, 1950.

Work Holding with Magnets

INCORPORATION of magnets in its fixture details for assembly operations, have piled up economies for American Blower Corp.

Production is concerned with welding vane assembly of fans up to seven feet in diameter. Experience has shown that an unbalanced fan is produced if there is any shifting of parts during the operation. Specifically, the problem appeared to revolve around the vane hub. Jig and fixture men, attacking the focal point of trouble, mounted a 16-inch circular steel plate at the center of crossed I-beams, then drilled the plate for 58 permanent magnets $1\frac{1}{16}$-inch in diameter. These magnets, made by Carboloy Dept. of G-E, were put in the plate and insulated by aluminum tubing and washers.

Now, when placed on the plate, the vane hub holds rigidly during welding of blades between hub and outer rings. The fixture takes work up to $82\frac{3}{4}$ inches in diameter with no trace of movement in vane blades, hub or outer ring.

electric controls

Part 3—A-C Motor Control

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MOTOR CONTROL can be understood better when the fundamental similarities of a-c motors are appreciated. Commonly used types are squirrel-cage, multispeed squirrel cage, wound-rotor, and synchronous motors. A typical control for a squirrel-cage motor is illustrated in *Fig.* 1. By knowing why motors function as they do, the tool engineer can obtain the performance he wants through proper control selection. A-c motor control, as discussed in this article, includes only the motor controller and the motor-running over-current protection. These are the bottom two blocks in the complete system shown in *Fig.* 2.

Similar Stator Design: All a-c motors have a primary winding, normally mounted in the stator as shown in *Fig.* 3. This winding, energized by the a-c power source, provides the magnetic-field flux necessary to help produce the rotational power. For this reason, all forms of primary winding a-c motor controls are basically alike.

The torque developed by the motor, is actually the resulting reaction of the magnetic field set up by the primary winding and the current flowing in the conductors or windings in the rotor of the motor. This secondary current is induced by transformer action from the magnetic field produced by voltage on the primary winding.

Current flow in the rotor and the strength of the magnetic field determine the amount of motor torque produced. For this reason, any change in primary voltage (determining the magnetic field strength and resulting secondary current) or change in secondary resistance (controlling the amount of

Fig. 1. Squirrel-eage motor control which provides d-c braking to shorten machine cycling time.

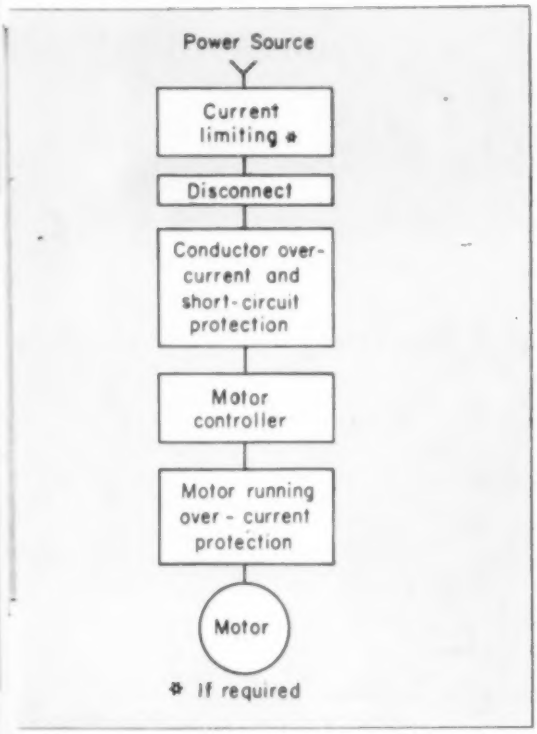


Fig. 2. Basic elements required in a complete motor-control system.

Table 1. Cost Comparison of A-C Motor Starters

Starting Method	Motor	Approx. Cost Index
Linestart (magnetic)	Squirrel-Cage	10
Autotransformer (manual)	Squirrel-Cage	45
Part Winding (magnetic)	Squirrel-Cage	47
Multispeed (magnetic)	Squirrel-Cage	50
Primary Resistance (magnetic)	Squirrel-Cage	54
Primary Reactance (magnetic)	Squirrel-Cage	55
Autotransformer (magnetic)	Squirrel-Cage	55
Star Delta (magnetic)	Squirrel-Cage	55
Secondary Resistance (semimagnetic)	Wound Rotor	87
Secondary Resistance (magnetic)	Wound Rotor	100

secondary current) will affect the resulting motor torque. Since the secondary current is also dependent on the magnetic field, any change in this field will produce a double effect on the motor torque (torque varies as the voltage squared).

Motor Types: The basic range of motor characteristics is obtained by using different types of rotors, *Fig.* 3. These differences are discussed in the following:

Squirrel-Cage Motors: In the case of a squirrel-cage motor, the rotor winding is actually a series of bars having short-circuiting rings attached to each end. The assembly, in most cases, is cast and has a fixed value of resistance. As long as the motor input voltage remains constant, the secondary current and motor speed-torque characteristics remain fixed.

By using rotors with different rotor resistances, a wide range of speed, starting torque, starting current and slip characteristics are obtainable, as shown in *Fig.* 4, to fit applications ranging from punch presses to lumbermill machines.

Wound-Rotor Motors: In the case of the wound-rotor motor, the rotor has a secondary winding with terminals brought out through slip rings. In this way, the amount of current flowing in the

Fig. 3. Basically different a-c motor characteristics are obtained by selecting different rotors.

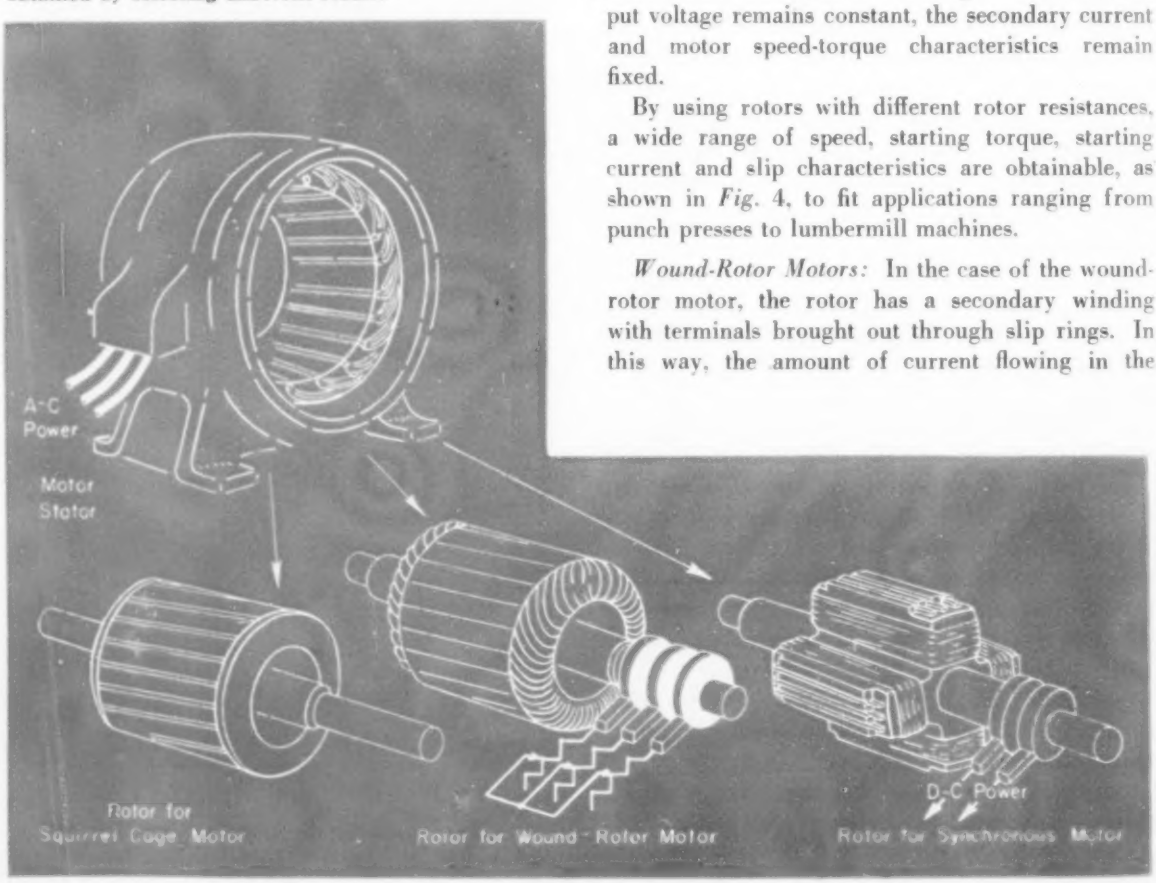
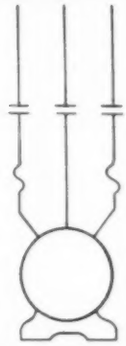
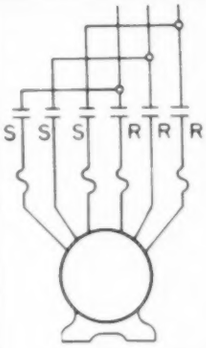
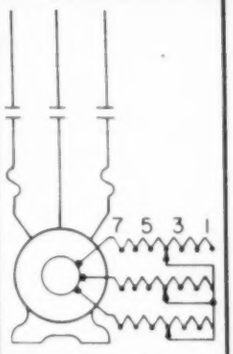
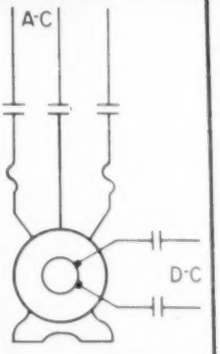
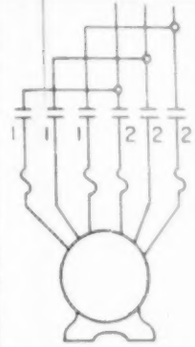
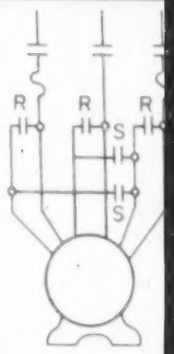
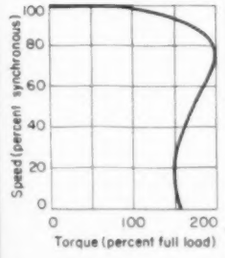
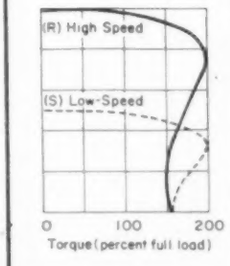
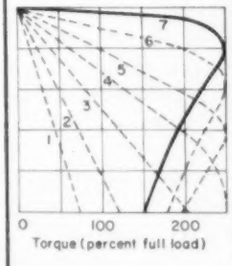
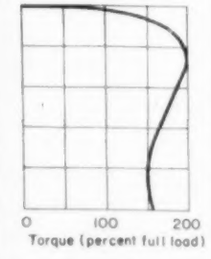
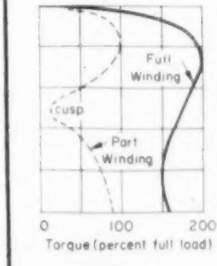


Table 2—Features of A-C Motor Starters

Starting Method	Across-the-line				Part Winding*	
	Squirrel-Cage Motor	Multispeed Motor	Wound-Rotor Motor	Synchronous Motor		Star Delta
Schematic of Power Circuit						
Basic Operation	Motor winding is connected directly to the power source through contacts operated either manually or magnetically.	Motor is linestarted on low-speed winding, then reconnected to high-speed winding.	Motor winding is connected directly to the power source through contacts operated either manually or magnetically. The secondary resistance governs the motor speed and torque output. As more resistance is shorted out, motor speed and torque increase.	Motor winding is connected direct to power source through contacts operated either manually or magnetically. When motor approaches synchronous speed the d-c power is connected to the field winding.	Full voltage is applied to half the motor winding. After a time interval, full voltage is applied to the second half of the motor winding.	For starting, full voltage is plied to the motor win connected in star. After a interval, the motor is de-gized and the windings immediately delta-conn with the reapplication of age.
Speed-Torque Characteristics						
Advantages	Control is simple and least expensive.	Control is simple and relatively inexpensive.	Maximum starting torque per ampere is obtainable. A wide range of speed control is possible.	Control is simple, least expensive in its class.	Contactors divide motor load and therefore can be half the size of a regular linestarter. Inexpensive means of providing increment starting. Provides closed transition.	Lends itself well to mo standard European conn such as 220/380 volt.
Disadvantages	Inrush currents are high.	Motor must be multispeed type. Open transition, motor is de-energized while transferring from low speed to high speed.	Basically more expensive than squirrel cage. Speed regulation is poor when using secondary resistors for speed control.	Inrush currents are high.	Motor windings must be divided into two or more groups, and leads brought out. A low-torque cusp in the starting curve limits the available starting torques.	Motors suitable for st starting must have w which can be connecte starting in star and wh ning in delta. Starting is limited to approxim full load rating. S starting is not usually p in the United State transition.

*These starters are equally applicable for synchronous motors as well as squirrel-cage motors. A field application control must be used with the synchronous motor however for applying d-c voltage to the field.

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eatures of A-C Motor Starters

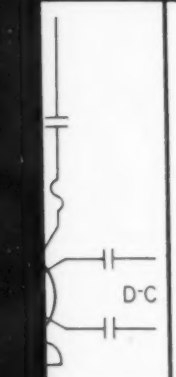
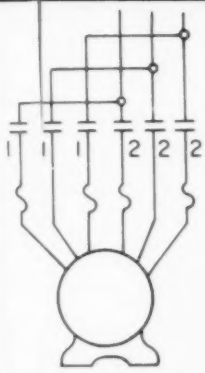
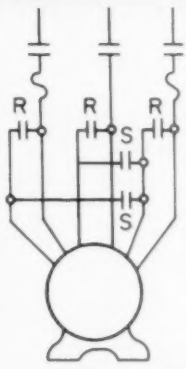
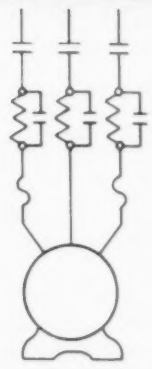
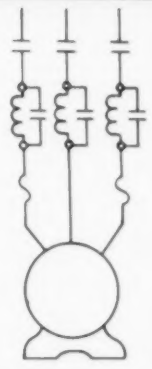
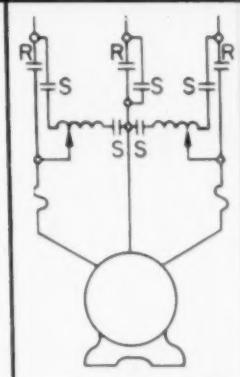
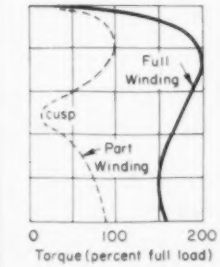
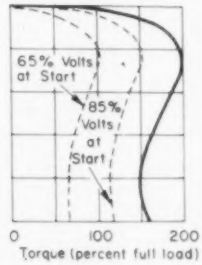
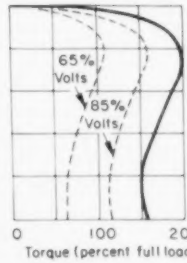
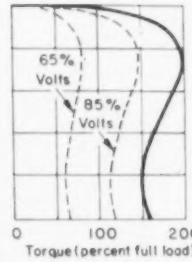
ous Motor	Part Winding*	Reduced Voltage			
		Star Delta	Primary Resistance	Primary Reactance	Autotransformer
					
g is connected r source through ted either man- etically. When hes synchronous power is con- ield winding.	Full voltage is applied to half the motor winding. After a time interval, full voltage is applied to the second half of the motor winding.	For starting, full voltage is applied to the motor windings connected in star. After a time interval, the motor is de-energized and the windings are immediately delta-connected with the reapplication of voltage.	The motor is connected to the line through a primary resistor, and reduced voltage appears at the motor terminals due to the voltage drop across the resistor. After a time interval, the resistors are shorted out and full voltage is impressed on the motor.	The motor is connected to the line through a primary reactor, and reduced voltage appears at the terminals due to the voltage drop across the reactor. After a time interval, the reactors are shorted out and full voltage is applied.	On start, the autotransformer is energized placing reduced voltage on the motor. After a time interval, the autotransformer and the motor are de-energized and full voltage is applied to the motor.
					
le, least expen-	Contactors divide motor load and therefore can be half the size of a regular linestarter. Inexpensive means of providing increment starting. Provides closed transition.	Lends itself well to motors of standard European connections such as 220/380 volt.	Starter is fairly simple and provides closed transition, since the resistor is shorted out without de-energizing the motor.	Starter is fairly simple and provides closed transition, since the reactor is shorted out without de-energizing the motor. Losses during starting are lower than resistor type	Starting losses low. More starting torque per ampere than resistor type.
ts are high.	Motor windings must be divided into two or more groups, and leads brought out. A low-torque cusp in the starting curve limits the available starting torques.	Motors suitable for star-delta starting must have windings which can be connected when starting in star and when running in delta. Starting torque is limited to approximately ⅓ full load rating. Star-delta starting is not usually practiced in the United States. Open transition.	Requires more amperes of line current for the same available starting torque than the autotransformer. Power losses are higher than autotransformer.	Requires more amperes of line current for the same available starting torque than the autotransformer.	Open transition, the motor is momentarily disconnected from the line when transferring from reduced to full voltage.

Table 3. Common Forms of Speed Controls for A-C Motors

Motor	Speed Control Method	Basic Operation	Advantage	Disadvantage	Typical Use
Squirrel-Cage	Jogging (inching).	Motor is momentarily energized (full voltage or reduced voltage) to jog the armature into rotation.	Inexpensive. Existing control can be arranged for jogging with a minimum of additional control.	This is an on-off operation and produces no definite speed.	Machine tools, lathes wherever small increments of movement (rotation) are needed for setup, inspection or checking before starting to run the machine.
Squirrel-Cage	Primary Resistance.	Resistance is inserted in each phase of the primary winding, to reduce the voltage to the motor. Increasing the resistance, decreases the speed for a given load.	Relatively inexpensive. Well suited to applications where the load varies approximately as the square of the speed.	Operating speed depends on load. Maximum speed reduction at full load, approximately 20%. Full speed range at low torque output only.	Cranes, hoists, machine tools, fans and similar applications where there is no overhauling load. (maximum horsepower approximately 30).
Multispeed	Pole Changing.	Either the motor has separate windings for each speed, or the winding is so arranged that it can be reconnected for different pole combinations.	Provides 2-3% speed regulation on any of its operating speeds. No power lost in auxiliary equipment. Full torque available. No horsepower limitation. Choice between constant torque, constant horsepower and variable torque type motors.	Motor must have proper windings. Limited to the synchronous speeds corresponding to the pole combinations. Maximum of 4 speeds, also maximum speed ratio of 4 to 1. Transition between speeds not smooth.	Machine tools, multispeed blowers.
Wound Rotor	Secondary Resistance.	Resistance is inserted in each phase of the secondary winding. Increasing the resistance decreases the speed for a given load.	Smooth speed control is obtainable. Full torque output is obtainable at any speed.	Speed regulation becomes bad for speeds less than 50% of synchronous speed.	Large compressors, fans, pumps, conveyors and cranes.

Table 4. Typical Braking Methods Used with A-C Motors

Method	Preferred Motor	Basic Operation	Advantage	Disadvantage
Plugging	All Types	Two leads are reversed on polyphase motor tending to drive motor in opposite direction. Power is removed when motor reaches standstill.	Least expensive. Simple. Provides braking torque relatively independent of speed.	During plugging, the inrush currents are high. Power must be available for braking. Some type of zero-speed switch may be needed. Plugging adds additional heating to motor. (3 times that of starting).
Shoe or Disk Braking	All Types	A shoe or disk brake is coupled to motor shaft. Motor is stopped by friction.	Provides braking action even on loss of power. Does not impose any additional heating in motor. Provides holding action at standstill.	Added expense of brake. Maintenance of brake shoes.
A-C Dynamic Braking	Wound Rotor	Single-phase power is connected to two primary windings. The less resistance in the secondary circuit, the more braking action.	Simple, inexpensive, good for overhauling loads on hoists.	Excessive heating requiring oversize motor. Braking action reduces with speed, zero at standstill. Must have power available for braking.
Regenerative	Multispeed Wound Rotor	Regenerative braking occurs when the motor is driven at speeds greater than synchronous speed. If a multispeed motor running at 1800 rpm speed is suddenly reconnected for a 900 rpm speed, it will regeneratively brake down to 900 rpm. Wound-rotor motors used on hoists frequently have overhauling loads which tend to drive the motor over synchronous speed.	Simple.	Must have power available for braking. Only available at speeds above synchronous.
D-C Dynamic Braking	All Types	Squirrel-cage & wound-rotor motors: D-c voltage is applied to the primary winding. The more d-c the more braking. In the case of the wound rotor the less secondary resistance the more braking. Synchronous: D-c voltage is applied to the field. The primary windings are shorted together or with some resistance in series to limit the braking.	Smooth braking action. Less losses than plugging. Braking torque easily controllable.	D-c power must be available for braking. No braking at standstill.

secondary winding can be controlled by means of external resistance as indicated in *Fig.* 3. Controlling the secondary current actually provides a control on the motor input current as well as the motor torque output, somewhat similar to the action in a transformer where the primary current depends on the amount of secondary current drawn.

Synchronous Motors: The rotor of the synchronous motor has two windings. The starting winding is analagous to a squirrel-cage rotor winding. Bars embedded in the face of the rotor make up the rotor make up of the squirrel-cage winding and also act as a damper winding when the motor is running. The running winding or field winding is located in the body of the rotor and is energized by direct current.

Multispeed Motors: The synchronous speed (revolutions per minute) of an a-c motor is equal to 120 times the supply frequency (cycles per second) divided by the number of poles. Synchronous speed is commonly used because speed varies somewhat with the load imposed on the motor and according to the "slip" designed into the motor as indicated in Fig. 4. All are designed to have less than 5-percent slip with the exception of Design D which may have slip up to 20 percent. The high slip makes this motor especially desirable for punch presses and other machines using flywheels.

If the primary winding of a motor is provided with 4 poles and energized from a 60-cycle source, the synchronous speed is 1800 rpm. If the winding has 2 poles, the speed is 3600 rpm. By placing two primary windings on one motor (both 4-pole and 2-pole combinations) the motor can be run at two different speeds, depending on which winding is connected to the line. A motor of this type is called a two-winding multispeed motor. If one primary winding is so designed that it can be reconnected to produce several pole combinations it is called a single-winding multispeed motor. If a squirrel-cage rotor is used, the motor is a multispeed squirrel-cage motor. A wound-rotor can also be used, giving the characteristics of a multispeed wound-rotor motor.

Motor Starters: The first basic operation in controlling any a-c motor is to energize or connect the motor to the power supply. This can be performed in many ways.

Linestarters: The most direct method is "across-the-line" starting, using a linestarter as shown in *Fig.* 5. The schematic diagram illustrating the power circuit is shown in *Fig.* 6. Either manually or magnetically operated, linestarters are used for many and varied applications. Since the magnet-

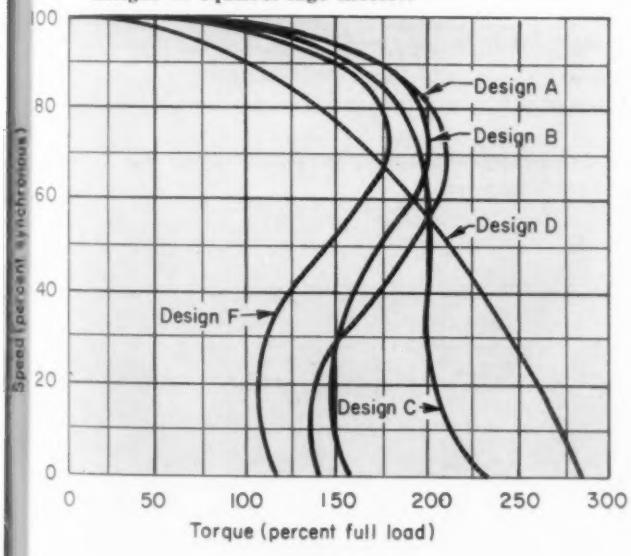
ly operated starter is controlled by a pushbutton or other pilot control, it has the advantage of flexibility, being operated either remotely or automatically, such as by a pressure switch.

Linestarting squirrel-cage motors involves high inrush current on the order of 600 percent of the motor full-load rating. This high inrush current, in some cases, is undesirable either because of the power-system limitations or because of the resulting jolt of high torque to the driven equipment. As an example, a conveyor belt carrying glass bottles would upset the material if a sudden surge of torque were applied. In applications where high inrush current or high starting torque cannot be tolerated, some form of reduced-voltage starting must be used.

Cost of the most common control schemes used today for starting a-c motors are listed in TABLE 1. Across-the-line or linestarter is the least expensive. Taking into consideration the price of the motor, the costs of the various starters compare somewhat as shown in TABLE 1. There are other considerations besides price, however. Control features are shown in TABLE 2 and are chosen to eliminate or minimize the high starting current inrush or torque developed by linestarting.

The multispeed motor and starter works well on loads such as high inertia mixers. The motor can first accelerate on its low-speed winding with a quicker reduction in current inrush than when attempting to get to the top speed in one step.

Fig. 4. Typical speed-torque curves for various NEMA designs of squirrel-cage motors.



Part-Winding Starter: This type of starter is often used for starting motor-generator sets, both squirrel-cage and synchronous motor types. While the cusp in the speed-torque curve, TABLE 2, is a limiting factor, the torque required to accelerate a motor-generator set in usually less than that value. The part-winding scheme does, in spite of its limitations, offer an inexpensive means of providing increment starting. This is often the requirement on network and other regulated power systems where the amount of power taken at any instant is limited.

Reduced-Voltage Starters: The star-delta starter lends itself well to motors of standard European connections such as 220/380-volt motors. Standard dual-voltage motors in this country are not designed for star-delta connections. They can, of course, be obtained on special order.

The primary-resistance starter, sometimes called a "cushion starter" is used where high starting torques and currents are not permissible and where a particularly smooth start is desirable. Certain conveyors where fragile material is handled, and rotating thread frames in the textile industry use this closed-transition type of starter to advantage. This type of starter is satisfactory for fan and blower applications because their torque requirements are low at the lower speeds.

The primary-reactor starter, identical to the resistor type except for the substitution of reactors, lends itself better to high voltage than a resistor. For that reason, this type is used on most high-voltage designs.

The autotransformer type starter is used with motors to drive pumps, blowers, machine tools, mill machinery and similar equipment where: (1) reduced voltage is required, (2) more torque per ampere of line current is needed and (3) open transition during starting is not objectionable.

When using a wound-rotor, a linestarter for the primary winding, with secondary resistance control, produces an effect comparable to reduced voltage starting. On high-inertia conveyors that are started under full load, the wound-rotor motor and control is ideally suited. It can produce 150 percent rated torque with a 150-percent full-load current inrush as contrasted with a squirrel-cage motor where 150-percent inrush current only produces 10-percent rated torque. Heavy-duty refrigeration compressors use this method because of the high-torque low-current characteristic as well as the speed control available.

The limited capacity of supply systems in the early days of induction motors forced the extensive use of wound-rotor machines. This reason still applies in many foreign countries. As squirrel-cage motor designs have been perfected and system capacities enlarged, the use of wound-rotor induction motors has been largely confined to applications such as cranes and other forms of hoists where particularly high starting torques and low starting currents are required simultaneously,

along with speed control. A recent innovation combines both primary and secondary resistance acceleration to minimize the saw-tooth type of speed-torque acceleration curve normally associated with acceleration by secondary resistance only. This method takes advantage of the fact that, when using a primary resistance, the primary motor current decreases as the motor accelerates with a resulting increase in motor terminal voltage causing essentially a constant torque condition with speed increase.

Motor Overload Protection: The second basic operation in controlling an a-c motor is to provide motor-running over-current protection. The main reason for this protection is to keep the motor from overheating. For this reason, the protective device must in effect measure the temperature of the motor.

The overload relay that affords this over-current protection is almost always located in the motor controller. The most commonly used overload relay is the thermal type. It makes use of the heat storing ability of a thermally responsive element and connected mass. Heat generated by motor current flowing through a resistance-type heating coil is either conducted or radiated to a heat sensitive element which causes the relay contact to open when the latter has reached a predetermine temperature. The heat sensitive element may be:

1. Bimetal strip which bends to actuate a conta mechanism. Usually must be reset manually.
2. Bimetal disk which snaps from convex to concave t operate the contacts. This system can be made t reset automatically.
3. Spring loaded shaft which is held by a low-melting alloy (solder-pot type) and rotates to operate the contacts when the alloy melts. Usually must be reset manually.

Thermal overload relays store heat and will operate in shorter time intervals for each successive starting of the motor, provided the elapsed time between the startings has not allowed the heating coils to cool to room temperature. Thermal overload relays are designed to follow the heating of the motors, but actually only a compromise condition is possible because of relay standardization. *Fig.* 7 shows a typical relay operating curve.

Sometimes magnetic coils are employed instead of heaters in overload relays. In this case, some form of dashpot action is used to create an inverse-time tripping characteristic. This type is generally used on crane applications. These induction and magnetic overload relays have greater accuracy than thermal types but do not accumulate the heating effect from start to start, since the relay quickly resets every time the motor is de-energized.

While overload relays are designed to simulate motor heating, thermal type devices are often fastened to the motor frames, especially on small motors. After an overload condition, the device stays locked out until the motor has cooled. It can be seen that it would take much longer for a device

Fig. 5. Typical standard linestarter for a squirrel-cage motor.

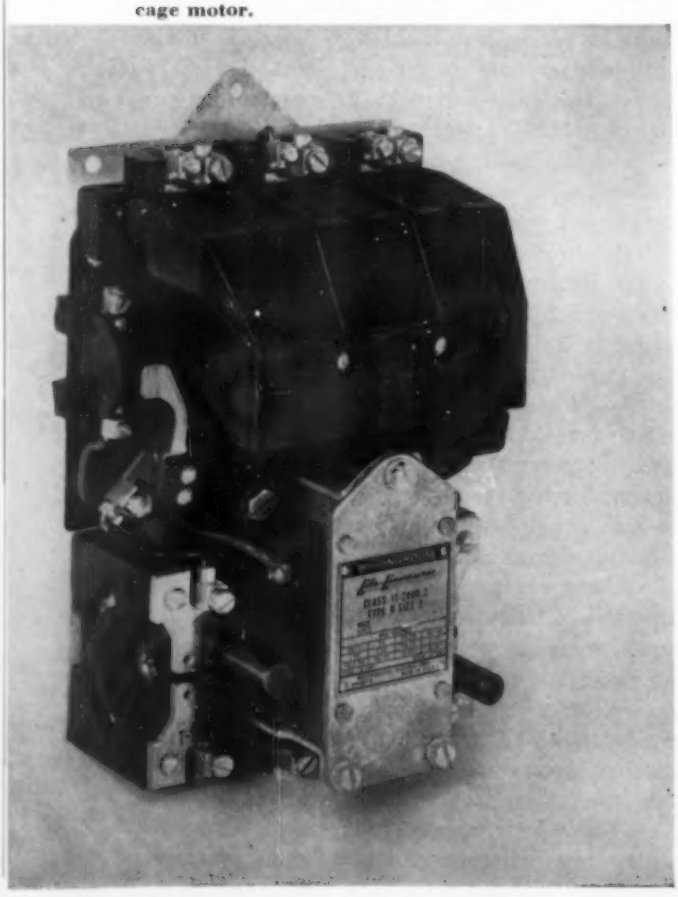
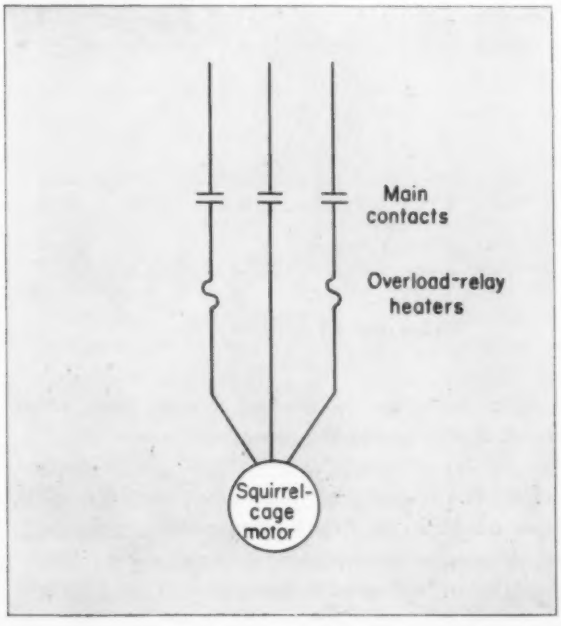


Fig. 6. Schematic diagram of power circuit for a standard linestarter.



mounted on a motor to cool than a remotely mounted overload relay. Many control schemes employing motor-mounted thermal protection feature a by-pass system so that the motor can be run no-load and thus permit quicker cooling of the motor.

Other Forms of Protection: Low line-voltage is a common hazard because it prevents motors from reaching rated speed on starting. While running, it causes motors to lose speed and draw heavy overload currents.

Low-voltage protection is provided inherently in a magnetic starter because the line contactors are maintained closed by a potential taken directly from the motor line or from a control transformer. Standard magnetic contactors will close on approximately 85 percent of line voltage and open as the voltage is decreased to approximately 60 percent. If a severe voltage-dip or a complete loss in line voltage should occur while the motor is running, the line contactor will open.

On many manual-type starters, the contacts are held in the "run" position by a small electromagnet which derives its electrical energy from the same power that energizes the motor. This provides low-voltage protection on these starters.

Phase-reversal protection may be necessary for such applications as elevators, hoists and conveyors, especially where the possibility of phase reversal exists. This condition can arise when emergency power supplies are used or when the transmission line is subject to frequent alterations.

Protection against the reversal of rotation of a polyphase motor is provided by a special type of relay that stops the motor upon reversal of the connection of any two of the phases, but remains inoperative when the desired phase sequence is maintained. The relay may also be of the type that operates on current or voltage.

Synchronous motors need damper-winding protection because the squirrel-cage starting winding is usually designed with limited thermal capacity. If the motor fails to reach its speed in the required time, a thermal relay opens the power circuit. A pull-out relay is also used to protect the synchronous motor if it "pulls out of step" due to a load beyond the capacity of the motor.

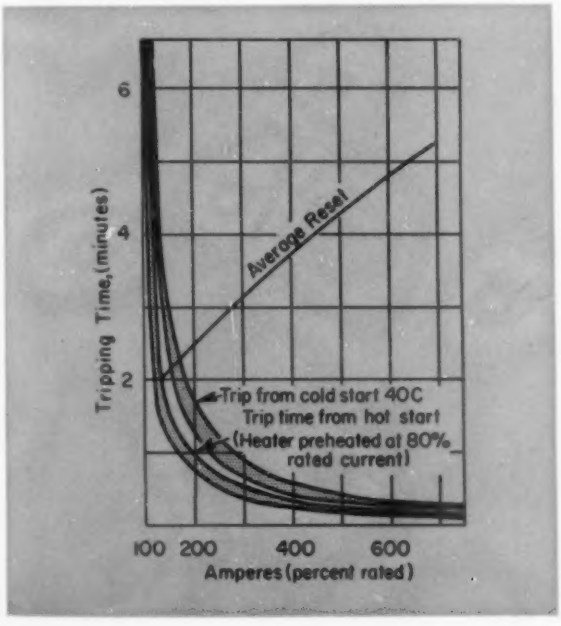
As motors become larger in size, investment increases and replacement is more inconvenient. For such motors, additional devices are used to protect the investment and maintain production, such as: motor-winding temperature detectors, bearing over-temperature detectors, insulation protection (space heaters), voltage-surge protection (lightning) and lubricating oil pressure switch.

Speed Control and Braking: A third operation in controlling an a-c motor may involve speed control. Most forms of electrical speed control for a-c motors employ the same theory as used in motor starting. TABLE 3 shows various systems used. Except for multispeed motors and frequency-changing systems, a-c motors operate at one relatively constant speed. When employing speed control methods, the load on the motor affects the speed. Of the methods shown in TABLE 3, wound-rotor motor and control is the best for adjustable speeds. With squirrel-cage motors, some form of mechanical speed control-pulleys, gears, levers, clutches or torque converters—is usually employed.

A fourth operation in controlling an a-c motor may be braking. In many applications such as compressors and fans, de-energizing the motor is sufficient because the load tends to brake the motor. Where quick stopping is desirable, as on automatic machine tools, one of the braking methods shown in TABLE 4 may be needed.

Many special motor designs are available in single-phase and in some brush type polyphase motors to do special jobs. The motors and controls discussed, however, cover the majority of normal applications. Visualizing their characteristics and scope, in spite of their generalized simplicity, gives the tool engineer an excellent background on a-c motor control.

Fig. 7. Average trip-time current curve for typical thermal overload relay.



CORRECTION: In Part 2 of this series on "Power Supply" published in the August issue an unfortunate error appears in TABLE 1. Headings for the first two columns are transposed, ie, a transformer rated at 150 kva may have an impedence of 5, 7 or 9 percent.—ED.

designed for

PRODUCTION

Die Casting Machine Largest Built

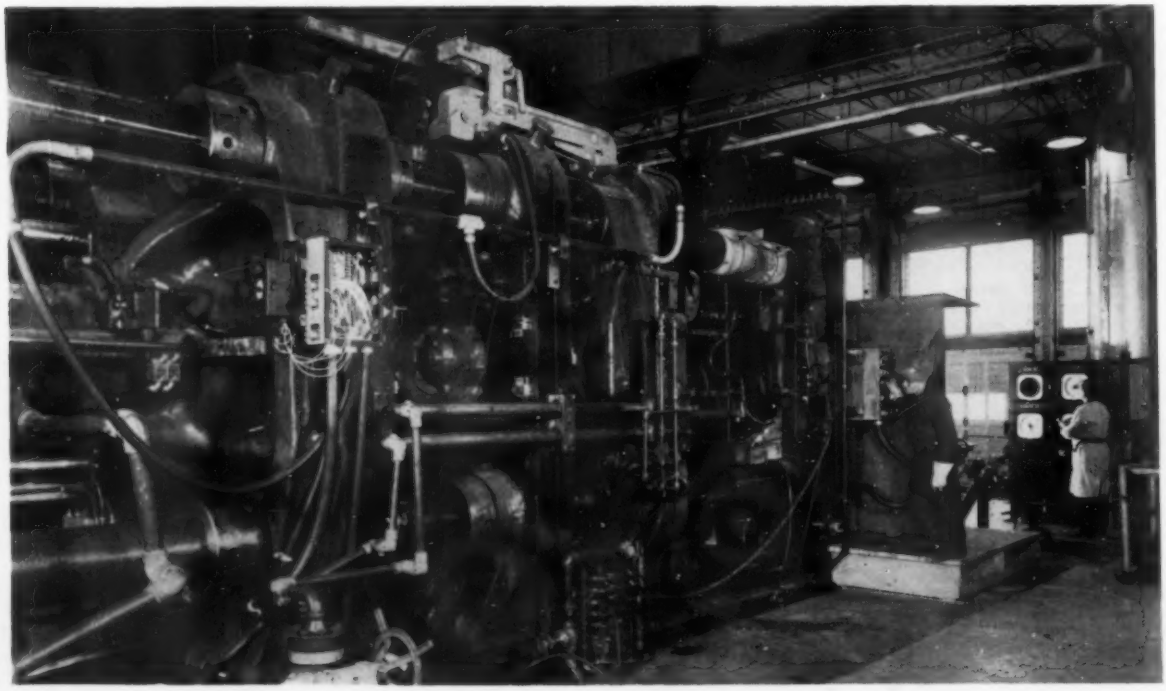
Conceived nearly five years ago and requiring two years for construction, the largest die casting machine ever built was recently placed in operation in Toledo. A joint development by Kaiser Aluminum & Chemical Corp. and the Doehler-Jarvis Div., National Lead Co., the new machine was built and will be operated by the latter company.

The machine has a capacity of 75 lb in aluminum and 200 lb in zinc die castings and will produce aluminum parts for the automobile industry that will be competitive with cast iron. Savings in weight would be large in such items as engine blocks.

The 72-inch machine derives its name from the center distance between adjacent tie rods. The tie rods stretch up to ⅛ inch in length when the dies are locked in position for the shot. The platens ride on huge rollers and two movable platens are locked together while the dies are open to prevent accidental closing. Wide opening between the dies, necessary for handling large, deep parts, is obtained by using two toggles in tandem.

While looking for a shape sufficiently large to test the machine, D-J engineers opened up a new market for aluminum die castings. Flanges for cable reels have traditionally been made of wood. They are now being made as aluminum die castings weighing only 30 lb apiece. Wood is 30 percent cheaper than the die casting but has an average service life of only three shipments compared to the five shipments possible with castings. Also, the casting has a $3 metal

DIE CASTING MACHINE with largest capacity in the world is not just an enlarged version of a former model. It was completely engineered as a new project because problems introduced by its size could not be solved by copying smaller machines. The machine is shown in the open position with the double toggles contracted. Operator at the control panel is looking into the die opening. Cycle of the machine can be automatically or manually controlled.



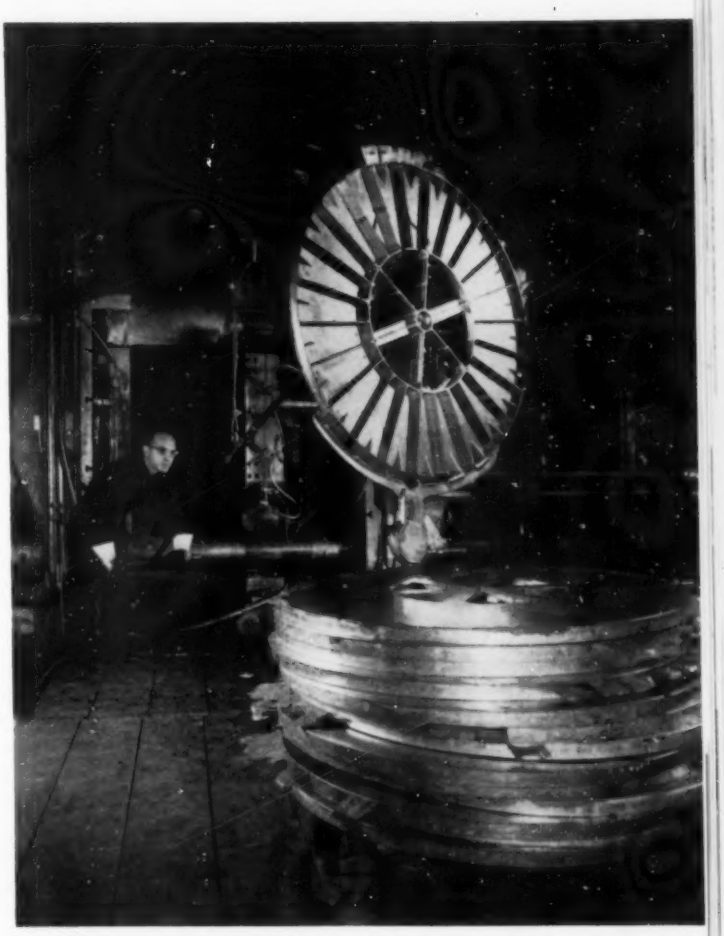
line when the reel is no longer serviceable.

The machine has a present capacity of thirty 75-lb shots per hour which would require 2,250 lb of metal. When die clean-up and application of die release agents are made automatic, about 60 shots will be possible per hour. To meet this high metal demand, two 12,000-lb reverberatory furnaces are used with the machine.

Because an operator could not manually handle 75 lb of metal, a special ladle is used. It runs on an overhead trolley between the furnaces and the magazine. The ladle is heated and temperature is automatically regulated to that point best suited for casting. A shot is determined by the angle to which the ladle is tilted and the time it is allowed to remain tilted. Repetitive accuracy of shot weight is high. Another feature of this machine is a water-cooled "cold" chamber to prevent clearance changes that would result in pressure losses.

Specifications

Size of die plates	105 by 105 inches
Diameter of tie bars	12 inches
Space between tie bars	60 inches
Maximum die opening	36 inches
Locking pressure	2000 tons
Shot cylinder diameter	8 inches
Shot plunger stroke	38 inches
Injection pressure on metal	6200 psi
Weight of machine	215 tons
Floor space for machine	10 by 44 feet



CABLE REEL FLANGE weighs 42 lb untrimmed and is removed from the die by this special snatch arm and cantilever support. Note general absence of flash indicating correct shot volume. The 42-lb shot of metal is forced into the die cavity in 0.22 sec. Dies up to 50 tons in weight can be used in this new machine.

Pantographs Join Production Line

Recently, conventional pantograph machines have been adapted for special operations on production lines where long runs and high production are required. By using several complete pantograph heads around a circular indexing table, multiple operations can be performed on piece parts without han-

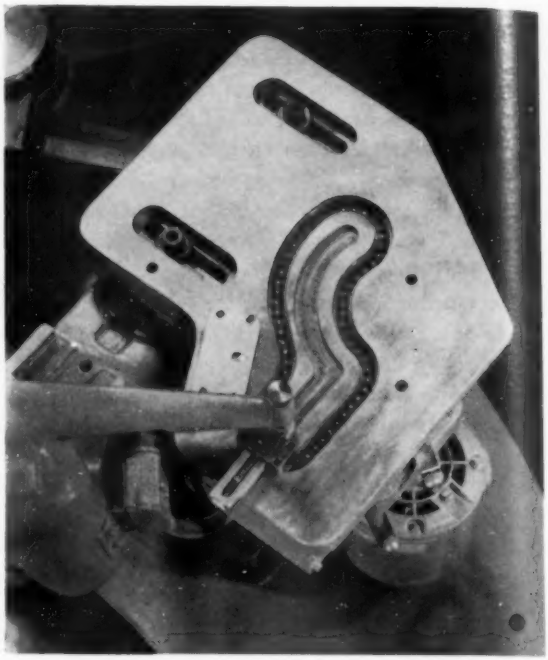
FOUR-SPINDLE PANTOGRAPH machine with indexing table cuts a serpentine groove in fuse parts. When the fixtures are loaded, the table indexes two work positions. The first two heads make roughing cuts and the second two make finishing cuts. Production ranges from 200 to 240 pieces per hour, depending on loading speed. All electrical controls are interlocked and are contained in the cabinet at the operator's right.

dling the parts between operations. These machines have been designed and built by the George Gorton Machine Co., Racine, Wis., and indicate the possibilities of using advantages of enlarged masters in countless production operations.

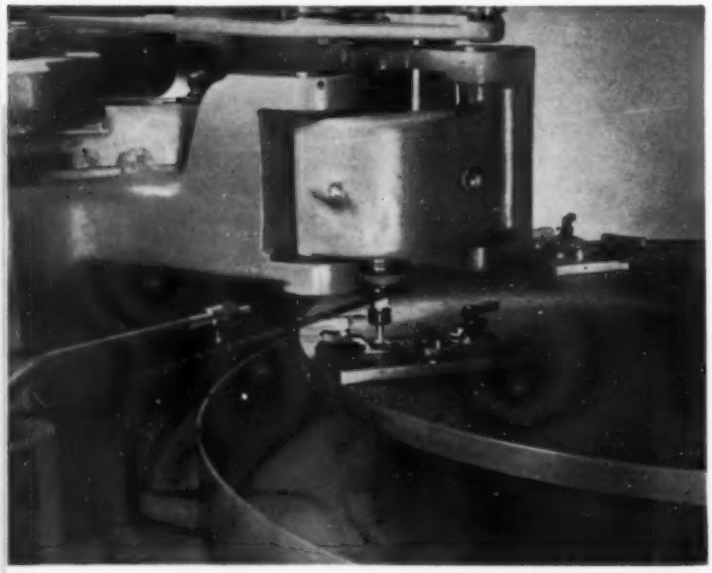
Two four-spindle pantograph machines with 45-inch indexing tables have been built for cutting a serpentine groove in fuse parts. The heads are located 45 deg apart and the operator loads and unloads two parts at a time at the open side of the table.

A two-head machine cuts the bezels (lens retaining grooves) in die-cast spectacle frames. One head cuts left-hand bezels and one cuts right-hand bezels. The bezel does not lie in a plane because it must fit convex lenses. The tracers and cutters must move vertically as well as in and out, and the tracer is controlled by forming guides and springs.

Down feed can be accomplished by an air cylinder, as with the two-head machine, or by a bell cam drive operating through a worm and worm gear to slowly feed the cutter down as it cuts laterally.



PANTOGRAPH MASTER shows the shape of the groove cut into the fuse part. For this head, the tracer is chain driven but the accuracy of the cut is governed only by the accuracy of the master groove. The chain drive can be run in either direction for conventional or climb milling. Tracer is in its home position with the tracer arm depressing a precision limit switch. In this position, the cutter is free of the work. When the table is indexed, the four tracers follow their patterns, make their cuts, return to home positions, depress the limit switches and stop. Each head has an individual spindle drive motor and another motor, working through an infinitely variable speed changer, to drive the master.



TWO-HEAD MACHINE cuts bezels in die-cast spectacle frames. The second head cuts the right-hand bezel and is shown in position just prior to the cut. Down feed to form the three-dimensional groove is accomplished in one motion by an air cylinder. The tracer and cutter are both retracted at the end of the cycle so the table can be indexed. The cutter cuts laterally and is a modified V-shape to form the correct retaining groove. Each head is separately powered so that optimum cutting speed can be used for the various operations that might be met in production.

Tie Wires Automatically Sized

Bench mechanics at Temco Aircraft Corp., Dallas, Tex., are cranking out tying wires of correct length instead of hand-snipping them to size since development of a wire-sizing and cutting machine. The machine sizes and cuts the 67,824 eleven and one-half-inch lengths of 0.041-inch wire annually required for two production projects in 18½ hours. Using hand dikes, it formerly required 452 hours to do the same job.

Each revolution of the crank produces one length

wire. Length of the cut wire can be varied by moving the point at which the pull rod connects to the wheel. Length of the wire equals twice the distance between the center of the wheel and the point where the rod joins it. Pressure can be increased on the wire pulling clamp so stiffer wire can be handled. The machine can be driven by a small electric motor if desired.

SAFETY WIRE is pulled the length of this automatic cutoff machine through an aluminum tube. It emerges from a bushing over which is mounted a tool steel cutter with a shear edge. Heart of the machine is a 12½-inch diameter wheel to which the pull rod is attached and on which is mounted a roller that actuates the cutter. The pull rod actuates a clamp mounted on a carriage which grabs and unreels the wire from a five-pound spool. A small coil spring raises the shear after each cut and a flat spring slows the wire spool so the wire won't backlash.

Rotating Tool Threads Lag Screws

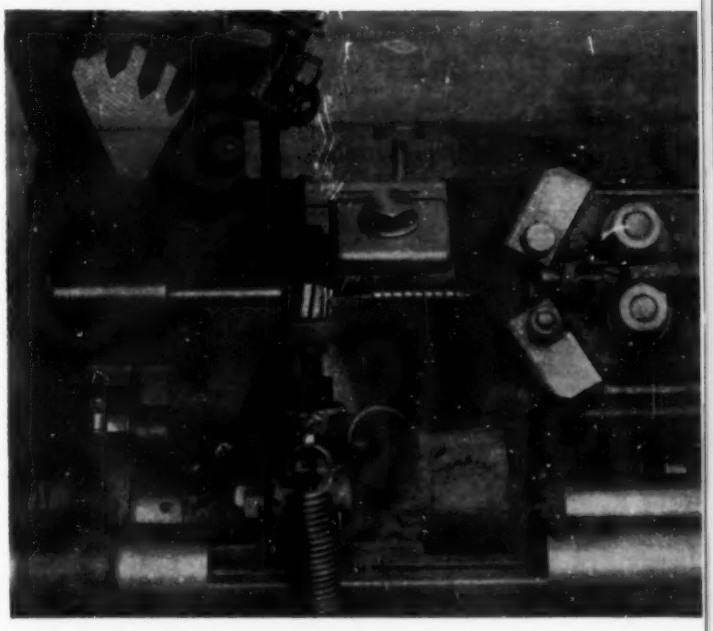
By Walter F. Wilhelm*

Professional Mechanical Engineer
Dayton, Ohio

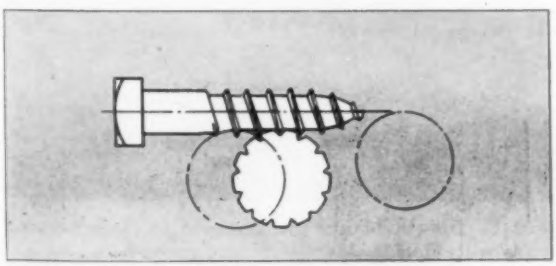
Originally designed for application behind what is now the Iron Curtain, an automatic lag screw threading machine illustrates an interesting use of a rotating tool. A headed blank automatically feeds from the hopper to the spindle chuck in about 2 sec. One operator can easily handle four machines.

The screw blank is held in a chuck and rotates at a speed determined by the type of material of the blank. The tool, with 13 teeth, rotates and at the same time is fed the length of the blank. Since there are several teeth on the tool, it can be operated for long periods without sharpening.

*Senior member ASTE Dayton chapter.



LAG SCREW threading machine shows a completed screw at the end of the machine cycle.



HEADED CYLINDRICAL blanks have points turned on one of the ends and are then placed in the machine hopper. Blanks feed from the hopper and are positioned in the chuck. The rotating tool is shown in cutting position and its two end positions are indicated.

cut color COSTS

Fig. 1. Press brake forms two 180-deg and six wide-angle bends on prefinished screen housings.

FOR THE FABRICATOR who has been using bare metal, then painting after fabrication, a switch to precoated coil stock can solve paint shop problems. In some cases, the paint shop is no longer needed, reducing insurance and overhead costs. One-time production orders can be met without expanded facilities or staff. Fabricated parts need not be sent outside the plant for final finishing.

Until recently, Roll-Away window screens were fabricated of electrogalvanized strip that could not be finished until the screen was installed. The unpainted metal, while the units were on display, and the need for painting were definite sales dampers. The formed parts—housing, vertical guides and bottom bar—could not be painted prior to assembly without heavy additional costs. Some of the parts have sharp bends, *Fig.* 1, and deep recesses that would not lead to uniform finish application by dip or spray.

The answer to the problem was found in precoated steel coil furnished by Enamelstrip Corp., Allentown, Pa. The coil is available in all colors, coated on both sides and in various widths. A neutral buff finish was chosen for the window screen housing because it would fit with any home interior color scheme.

Despite the severity of some of the forming operations, the paint on the coils does not chip, crack or flake. The finish is bonded to the metal by a process that permits the final stock to be stamped, pierced, embossed or drawn without appreciable damage to the painted surface, *Fig.* 2.

The basic economies of fabricating from coil are retained in precoated coil. Use of coil stock does away with shearing of sheets and stacking of strips. Automatic coil feeds permit fast press speeds and enable one man to handle several presses at one time.

Savings from increased production are further augmented by low scrap losses. With strips cut from sheets, scrap is lost at each end of the strip. With coil stock, this loss is confined to the beginning and end of a long coil. Strips sheared from sheets do not always cut evenly, which adds to the scrap loss. Precoated coil stock can be obtained in the exact width to fit the particular application.

Fig. 2. Die-cut blanks are stamped to form housing ends with slots, holes, bends and recesses.

die design

how to save development time

By **Bernard K. H. Bao***

Chief Engineer
Alpha Products, Inc.
Chicago, Ill.

DRAW AND EXTRUSION DIE development is often performed in the shop by slow cut-and-try methods. It should be the responsibility of die designers to provide die makers with shell heights, blank diameters, and draw and extrusion cup heights. Designers can save die development time by using the Pappus (or Guldinus) theorem to calculate the necessary dimensions.

This theorem relates the area of revolution to the center of gravity of the shape that generated it. When a line, *Fig.* 1, is rotated about an axis lying in the same plane but not crossing it, the area generated is equal to the product of the line length and the circumference of the circle about the axis described by its center of gravity, or:

$$A_g = 2\pi xL \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

where

A_g = Surface area generated, sq inch

L = Length of shape, inch

x = Distance between axis and center of gravity (moment arm), inch

A variation of this theorem is used to determine the volume of revolution, *Fig.* 2, generated by rotating a plane surface about an axis.

$$V_g = 2\pi xA \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

where

A = Area of plane surface, sq inch

V_g = Volume generated, cu inch

Resultant Moment Arm

If the generating line is composed of several arcs and straight lines, the resultant moment arm and the total developed length should be used in Equation 1. The resultant moment arm can be found by calculation or graphical methods.

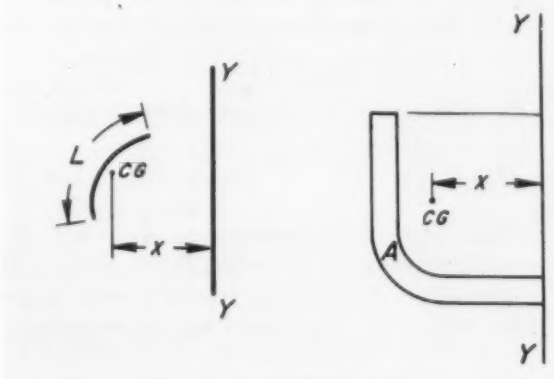


Fig. 1. (left) Elements of surfaces of revolution.

Fig. 2. (right) Elements of volumes of revolution.

The conditions illustrated in *Fig.* 3 are representative and indicate a shape composed of two straight lines and an arc. When these lines are rotated about the axis, they describe a cylindrical

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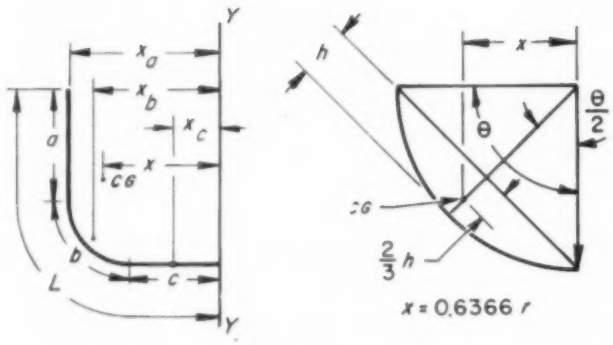


Fig. 3. (left) Graphical representation of resultant arm for compound shape.

Fig. 4. (rt.) Center of gravity of 90-deg. circular arc.

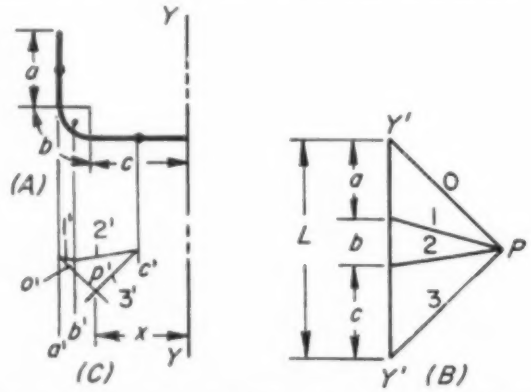


Fig. 5. Graphical determination of resultant moment arm for compound shape.

cup. The surface area of the cup is equal to the sum of the surfaces generated by each line, or:

$$2\pi xL = 2\pi x_a a + 2\pi x_b b + 2\pi x_c c$$

From this equation the moment arm becomes:

$$x = \frac{(x_a a + x_b b + x_c c)}{L} \quad \ldots\ldots (3)$$

Since most arcs encountered in die design are one-quarter segments of circles, *Fig.* 4 is included to show where the center of gravity of such an arc falls. Calculators are available for determining arc lengths for any included angle, or they may be individually calculated.

At *(A)* in *Fig.* 5, is a simple figure of two straight lines and an included arc. The graphical method for determining the resultant moment is shown at *(B)* and *(C)*. A layout of the shape is made at full or enlarged scale, depending on the accuracy required. It is then divided into its geometric components: straight lines *a* and *c*, and circular arc *b*.

Line *Y'-Y'* is drawn parallel to axis *Y-Y* at some convenient point and lengths *a*, *b* and *c* are marked off on it. From the end points, lines 0 and 3 are constructed at 45 deg to *Y'-Y'*, intersecting at point *P*. From the ends of segment *b*, lines 1 and 2 are drawn through *P*. In *Fig.* 5*A*, vertical lines *a'* *b'* and *c'* are dropped from the centers of gravity of the three component lines. At any point on line *a'*, line 0' is drawn parallel to line 0. From the same point on *a'*, line 1' is drawn parallel to line 1. At the point of intersection between lines *b'* and 1', line 2' is drawn parallel to line 2. Line 3' is drawn parallel to line 3 from the intersection of lines 2' and *c'*. The intersection, point *P'*, of lines 0' and 3' determines the *x* value of the resultant center of gravity.

Moment arms for solids of revolution can be determined similarly. The only difference is that centers of gravity for areas are used instead of for lines. Areas of shapes such as shown in *Fig.* 2, can be calculated or determined by mechanical integrators. Resultant moment arms of such shapes can be determined by formulas furnished with the instruments.

Application to Die Work

Determining Blank Diameter. Blank diameters of cylindrical shells can be calculated by adding an allowance to the final shape for trimming, dividing the half shell contour into its several sections along the center of shell stock thickness and following through the previously indicated computations. Since the value of the area is not needed, blank diameter, *D*, can be found from Equation 1, or directly by using:

$$D = \sqrt{8xL} \quad \ldots\ldots (4)$$

Blank diameters can also be determined graphically. To a full scale drawing of the shell an allowance for trim stock is added. The resultant moment arm is found by the graphical method previously outlined. At *(B)* in *Fig.* 5, the bottom of segment *c* is used as a center and a circle with diameter equal in length to *x*, is drawn, *Fig.* 6. With the top of segment *a* as a center, an arc with a radius of $L + x/2$ is scribed. A horizontal tangent is drawn from the top of the construction circle to intersect the arc at point *C*. The distance from point *C* to the *Y'-Y'* axis is equal to one-half the blank diameter.

The mechanical method is applied in the determination of blank diameters by finding the blank volume as previously described. By equating the volume of the blank with the volume of the shell, the blank diameter, *D*, can be determined from Equation 2 or directly from:

$$D = \sqrt{\frac{8xA}{t}} \quad \ldots\ldots (5)$$

where t is the stock thickness.

The actual blank diameter found to be adequate

during proving trials should be close to that calculated. If the diameter is substantially less, it indicates that stock is being thinned, which will result in off-specification parts.

Shell Heights: For a sequence of redrawn, flangeless shells, the blank diameter can be determined by the graphical method using a drawing of the final shell, *Fig. 7B*. To find intermediate shell heights, intermediate moment arms must be determined. These can also be found by graphical methods. From Equation 3 and *Fig.* 3, it can be seen that if everything else remains constant, a small variation in the length of vertical line a will not affect the resultant moment greatly. Thus, by assigning approximate values for the vertical wall heights, approximate resultant moment arms for intermediate shells can be found.

If there is no trimming between draws and if stock does not thin, surface areas of preliminary shells equal that of the finished shell. That is:

$$2\pi xL = 2\pi x_1 L_1 = 2\pi x_2 L_2$$

where subscripts represent intermediate shells. Then:

$$L_1 = \frac{xL}{x_1} \text{ and } L_2 = \frac{xL}{x_2} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (6)$$

Since the total lengths L_1 and L_2 along the center of stock thickness are known, the straight wall heights can be found by subtracting all the known lengths from L_1 and L_2. The heights thus found are generally accurate enough for practical purposes. If more accurate heights are desired, the approximate wall heights found are used to revise the graphical solutions for x_1 and x_2. New values for x_1 and x_2 are substituted into Equation 6. New values for L_1 and L_2 are found, from which more accurate values for wall heights can be determined.

Shallow, sharp-cornered cups, as depicted in *Fig.* 7, are usually made from preliminary cups having large (3 to 6t) corner radii, slightly larger diameters and slightly higher walls. The cup is then reduced and the corner set to its finished shape. Reduction in diameter is usually only a few thousandths of an inch with 1/64 inch being maximum. When finding a_1, d_1 may be assumed equal to d, the finished shell mean diameter. In Equation 6, x_1 is approximately equal to x, thus $L_1 \approx L$ and:

$$a_1 = L_1 - b_1 - c_1 = L - b_1 - c_1 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (7)$$

$$h_1 = a_1 + r \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (8)$$

where

a_1 = Straight shell wall height, inch

h_1 = Inside shell height, inch

r = Inside corner radius, inch

By using Equations 7 and 8, straight wall and inside shell heights of preliminary shells can be determined by calculating lengths instead of surface areas or volumes.

When planning for redrawn flanged shells, it is important to keep the surface area of successive shells constant so the shapes can be drawn without crowding or thinning the metal. Equation 6 can be used with wide-flanged shells. The outside contour of the flange should be kept the same for all draws. After assigning the diameter of draw, flange and corner radii are found using the same procedure followed for finding wall heights of preliminary, flangeless shells.

The theorems of Pappus are also useful in determining cup heights for drawing and extruding work. In this type of work, *Fig.* 8, metal is first drawn to a cup, a hole is punched in the bottom and the bottom is extruded to obtain a high wall without annealing. Such parts are generally made in progressive dies. To lay out the die correctly, it is important to predetermine the stock width and progression. Blank diameter and number of draw stations cannot be determined before the height of the drawn cup is found.

The limit without cracking, when expanding the punched hole to the size of the mean cup diameter,

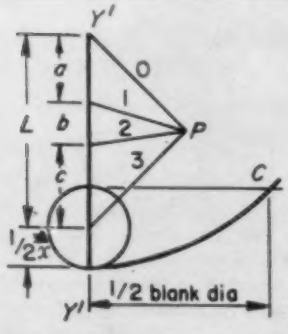


Fig. 6. Graphical method for determining blank diameter.

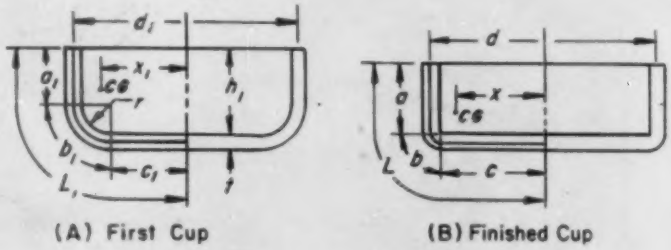


Fig. 7. Initial and final forms of shallow, sharp-cornered cup.

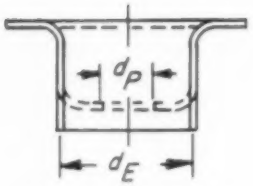


Fig. 8. Cup for draw and extrude work.

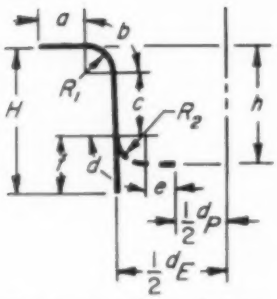


Fig. 9. Centerline of shape shown in *Fig.* 8.

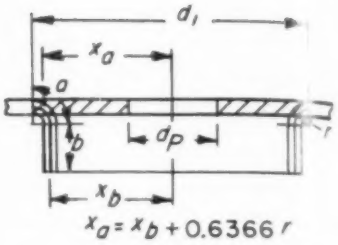


Fig. 10. Determining extrusion perforator diameter.

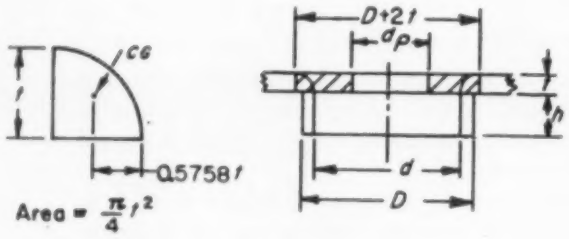


Fig. 11. Extrusion of thick stock with ironing. Location of center of gravity of one-quarter circle area shown in sketch at left.

is 30 percent. This relationship can be expressed as:

$$d_P = \frac{d_E}{1.3} \qquad (9)$$

where

d_E = Mean cup diameter, inch

d_P = Minimum hole diameter, inch

The hole diameter should usually be larger than the value obtained by Equation 9. Whenever possible, the hole should meet the bottom radius to avoid the straight portion *e*, *Fig.* 9, and simplify calculations.

The bottom radius, R_2, should be at least 4.5 times the stock thickness to avoid thinning the metal at the corner. *Fig.* 9 illustrates the half-section of the cup through the center of stock thickness. The section is divided into segments *a*, *b*, *c*, *d* and *e*, for which lengths must be found. The moment arms for each section are designated by the subscript corresponding with the line to which they apply.

The surface areas of sections *d* and *e* of the cup must equal the surface area of section *f* of the finished wall, or:

$$2\pi x_d d + 2\pi x_e e = 2\pi x_f f$$

then

$$f = \frac{x_d d + x_e e}{x_f} \qquad (10)$$

If the punched hole diameter is sufficiently large so that a flat section *e* is unnecessary, Equation 10 becomes:

$$f = \frac{x_d d}{x_f} \qquad (11)$$

After *f* is determined, height *h* of the cup is found in the following manner:

$$c = H - R_1 - f \qquad (12)$$

$$h = c + R_1 + R_2 \qquad (13)$$

When the straight section, *c*, of the wall is known, the blank diameter for the cup, the stock width and the progression can be accurately determined.

Final step in design for such a draw is to calculate the percentage of reduction when drawing the cup. If reduction is too great to be accomplished in one draw, a second draw station must be included.

Similar techniques can be used when determining diameter of perforator punches for extrusion. As shown in *Fig.* 10, a hole is first perforated in the blank and then the blank is drawn to form a flange. If the flange is not ironed, surface area equals surface area of the portion of the blank being drawn. From this it follows that:

$$(d_1^2 - d_P^2) = 8\,(x_a a + x_b b)$$

$$d_P = \sqrt{d_1^2 - 8(x_a a + x_b b)} \qquad (14)$$

This equation is useful when perforators are to be ordered from an outside source. The size ordered should be 1/64 inch larger than the diameter calculated.

With the thick stock and sharp die corners, the flange will be ironed, *Fig.* 11. The diameter of the required perforator is determined by equating volumes as follows:

$$\pi[d + 2\,(0.5758t)]\left[\frac{\pi}{4}t^2\right] + \frac{\pi}{4}(D^2 - d^2)h = \frac{\pi}{4}[(d + 2t)^2 - d_P^2]t$$

$$d_P = \sqrt{(d + 2t)^2 - \pi(d + 1.1516t)t - (D^2 - d^2)\frac{h}{t}}$$

If a clean edge is desired, d_P must be greater than $D/1.3$.

tool control

for multiple-spindle machines

By Harry Conn*

Chief Engineer
Scully-Jones Co., Chicago, Ill.

TRANSFER and other types of multiple-spindle machines are providing users with production benefits. Compared to conventional production methods, these machines perform several operations with fewer operators. Top management is becoming increasigly aware of these advantages and is giving closer attention to the tooling details and cost features of multiple-spindle machines.

Among the tooling factors now being considered are: length of life per grind, number of grinds per tool, length of change-over time, presetting ability and avoidance of in-machine adjustment. Efforts are being exerted by engineers to minimize the possibilities of tool failures and to lower costs.

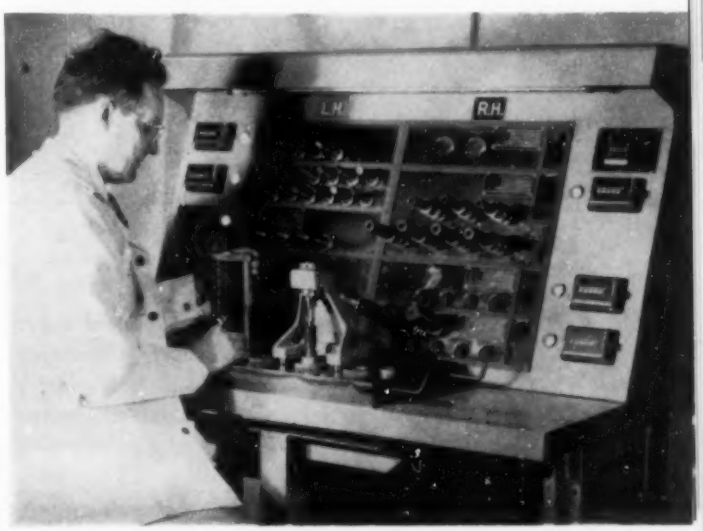
Because of the high initial cost of a multiple-spindle machine, it must produce many units to justify its use. A considerable amount of production is lost during down time if tools are adjusted while they are in the machine. The following assumptions should be true if a part has been correctly processed and the tools are designed to enable the tool setter to adjust them outside the machine.

1. A properly ground tool, correctly preset and inserted, should cut satisfactorily.
2. Preset tools should eliminate adjustment of the machine and of the tool while in the machine.
3. Correct setting should prevent a tool striking the workpiece while in rapid traverse.
4. Correct setting should also eliminate cut and try, and inspection of the workpiece while in the machine.

*Senior member ASTE Chicago chapter.

Tooling economies can be obtained in two ways: by maintaining an accurate count of the number of pieces machined by each tool and by careful attention to sharpness. Tools that require sharpening after 2000 pieces may require only 0.008-inch stock removal from the cutting edge. If the same tool were to cut 2300 pieces it would require removal of 0.032-inch stock, lowering tool life 75 percent.

Fig. 1. Tool control board equipped with gages for presetting tools to eliminate adjustments in the machine. Tool setter is setting drill projection with a special height gage.



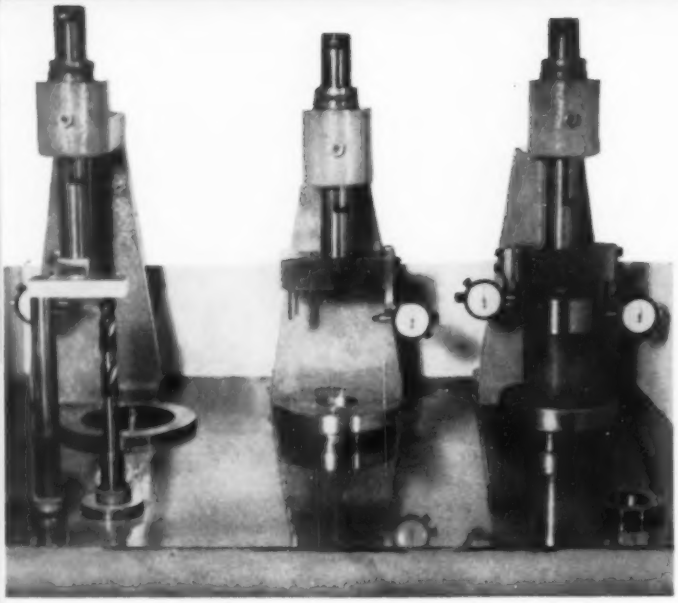


Fig. 2. Gages and indicators determine concentricity of tools and adapters.

Tool Control

A tool control board, *Fig.* 1, has been developed to cut tool costs by regulating cutting tool performance. Counters, connected to the machine or machines and mounted on the board, record the number of pieces cut by an individual tool. When a predetermined number of machined parts for any tool is registered on the counter, the machine shuts down. Lights on the board indicate which tool requires replacement.

The board is divided into right and left sides to correspond to the two sides of the machine. For machines with vertical stations, the tools and gages may be located at the center of the board. Each machine station and spindle has an allotted space with a nameplate to identify and describe the tools it contains. Spare tools are stored in holes under the corresponding nameplate. The tool setter knows immediately whether or not he has spare tools ready for insertion.

Drills, reamers, counterbores, taps and other tools can be preset in their adjustable adapters by the tool setter before insertion in the machine. Setting gages and fixtures are grouped in one location. One man can set the tools for several machines.

A surface plate contains various size bushings, *Fig.* 1, to hold an adapter and its tool during presetting.

Adjustments are made with the tools upside down in the bushings and set to a definite dimension from the cutting edge to the back side of the adapter nut. Shown in *Fig.* 2 are special gages and indicators which enable the tool setter to check the adapters and tools for concentricity, size and projection. After removing the master, the adapter and tool are inserted and revolved to check concentricity and size. Indicators are set with a master made to the mean diameter of the part dimension.

Gages: A special height gage, *Fig.* 2, is used for resetting the projection of drills, taps and reamers after resharpening. Step drills being used for countersinking operations, counterbores and other close depth tolerance tools are adjusted on a flush-pin gage, *Fig.* 3. Tolerances of ± 0.003 inch and less are set with the flush-pin gage and a dial indicator to measure the step. The gages are set after the first run of good parts has been made. This is necessary because of variables such as overall length and tolerance of machine spindles, depth of the bearing diameter counterbore in drill heads.

Tool Cost and Performance Chart

Tool Identification (No.)	Description of Tool	Function of Tool	Cutting Speed (rpm)	Tool Feed (ipr)	Cutting Speed (fpm)	Parts Per Grind (No.)	Usable Tool Length (in.)	Grinds Per Tool (No.)	Cost of Tool ($)	Tool Cost Per Unit ($)
GB-5831	31/64 dia HSS Drill (8 5/16 lg.)	Dr. (1) hole to 3 7/16 dpth.	475	0.006	76	1985	1 3/4	18	4.25	0.00012
GB-6471	3/4 dia Carbide 6 Flute reamer	Ream (2) holes	408	0.027	80	2795	1 1/4	15	14.20	0.00034
GB-7321	33/64 HSS 90° Pt. Chamf.	Chamfer (2) 5/8 dia c'bore 90° x 0.695-0.705 dia.	407	——	70	15540	1 1/8	15	10.25	0.00004
GB-8178	31/64 dia Step Drill	Core Dr. (2) holes in face (150°) for 0.963 dia rm.	294	0.014	72	2988	1 3/8	22	16.55	0.00025

Note: $\frac{\text{Cost of Tool}}{\text{Grinds per Tool} \times \text{Parts Machined per Grind}} = \text{Tool Cost per Unit}$

Tool Costs and Performance

The accompanying table represents a method for accurately controlling performance and cost for method of mounting the way-type units and tool length variations.

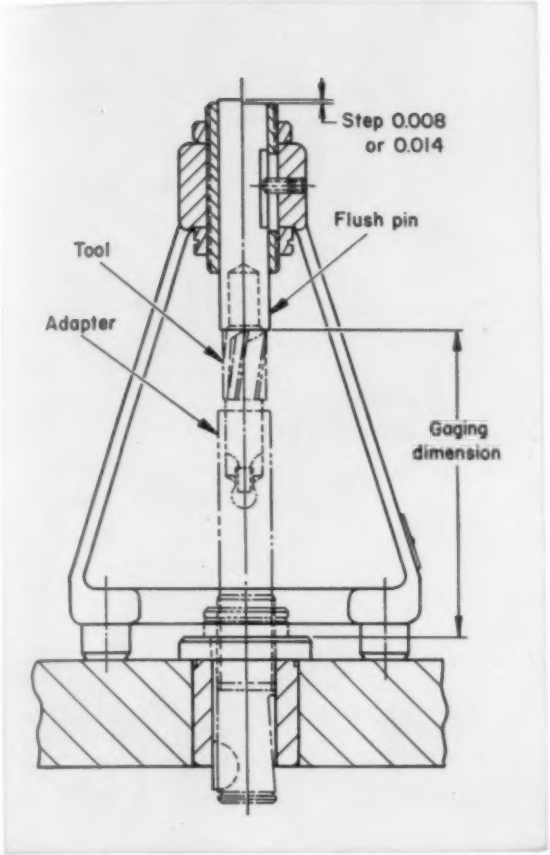


Fig. 3. Flush-pin gage designed to preset tools by measuring distance between cutting edge and adapter nut. Inside of flush pin is machined to contour of cutting edge.

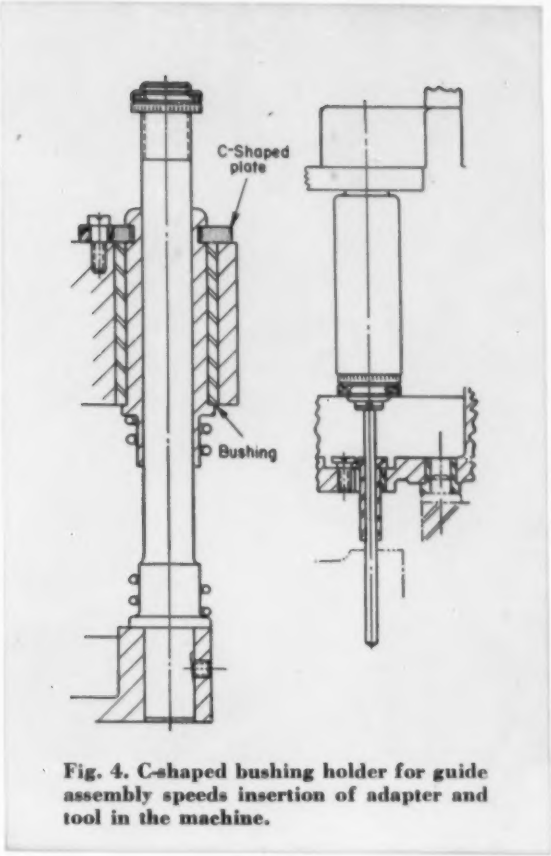


Fig. 4. C-shaped bushing holder for guide assembly speeds insertion of adapter and tool in the machine.

individual tools. Excessively high tool costs result from incorrect feeds or speeds. High costs in relation to the number of pieces machined are readily determined from the data. Following are factors that should be considered to reduce costly down time due to tooling.

Drills should be inserted into the adapter and preset before being placed in the machine. However, designs of many special machines prevent the proper insertion of drills. The over-all length of the drill and adapter is often too long for the amount of clearance between the spindle end and the top of the bushing. The bushing holder plates for the guide assembly shown in *Fig.* 4 are C-shaped to facilitate raising the spindle head for inserting the drill and adapter simultaneously. This C-shaped plate enables the tool setter to run the head up and leave the plate in a down position, providing vertical clearance between bushing heads and spindle ends. The C-shaped plate can be turned 180 deg to provide clearance and separate them from the heads.

Another solution involves the use of bushing plates that remain stationary. Ways must be long enough for the dogs on the side of the heads to be tripped, thereby enabling the heads to retract far enough for removal or insertion of preset tools.

Provisions for presetting tools should be considered when planning and designing a multiple-spindle machine. One manufacturer increased production by 688 pieces for each eight-hour shift by presetting the tools.

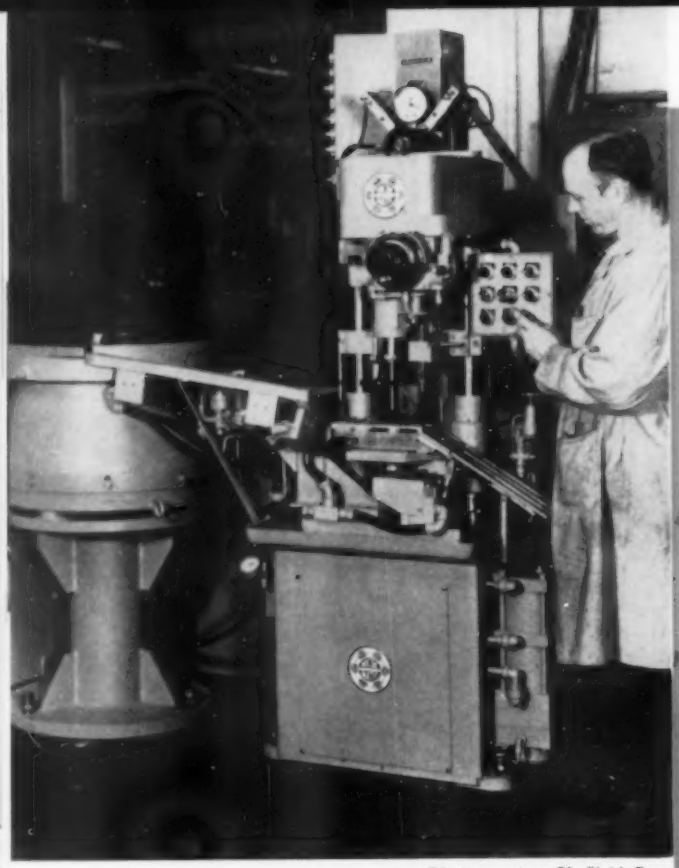
An indirect benefit from tool presetting is the lessening of machine spindle abuse by the use of hammers and drifts. Tool control board surface plates are equipped with keyhole-type tool ejectors, *Fig.* 1, which eliminate the use of drifts.

Tools should be designed to allow an over-all adjustment of their length to compensate for the amount ground off during sharpening. This is usually accomplished by using an adjusting screw and nut in the opposite end of the holder from the cutting edge.

Spindle ends should be ground to an equal length when more than one spindle in a head is used for tools that perform the same operation. If all spindles are the same length, one gage can be used to set all these tools.

Advancements in the field of automation can be increased by giving close attention to the control of cutting tools. Control can effect cost savings by minimizing down time and improving product quality.

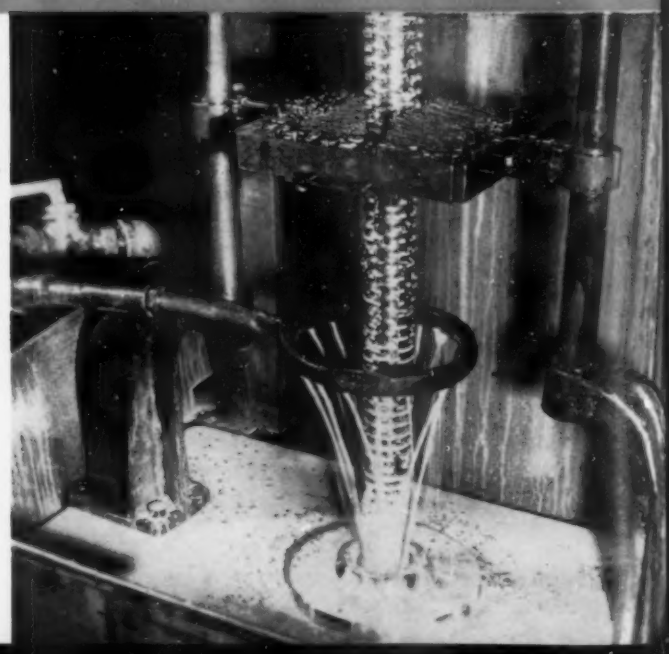
TOOLS at work



—Photo courtesy Sheffield Corp.

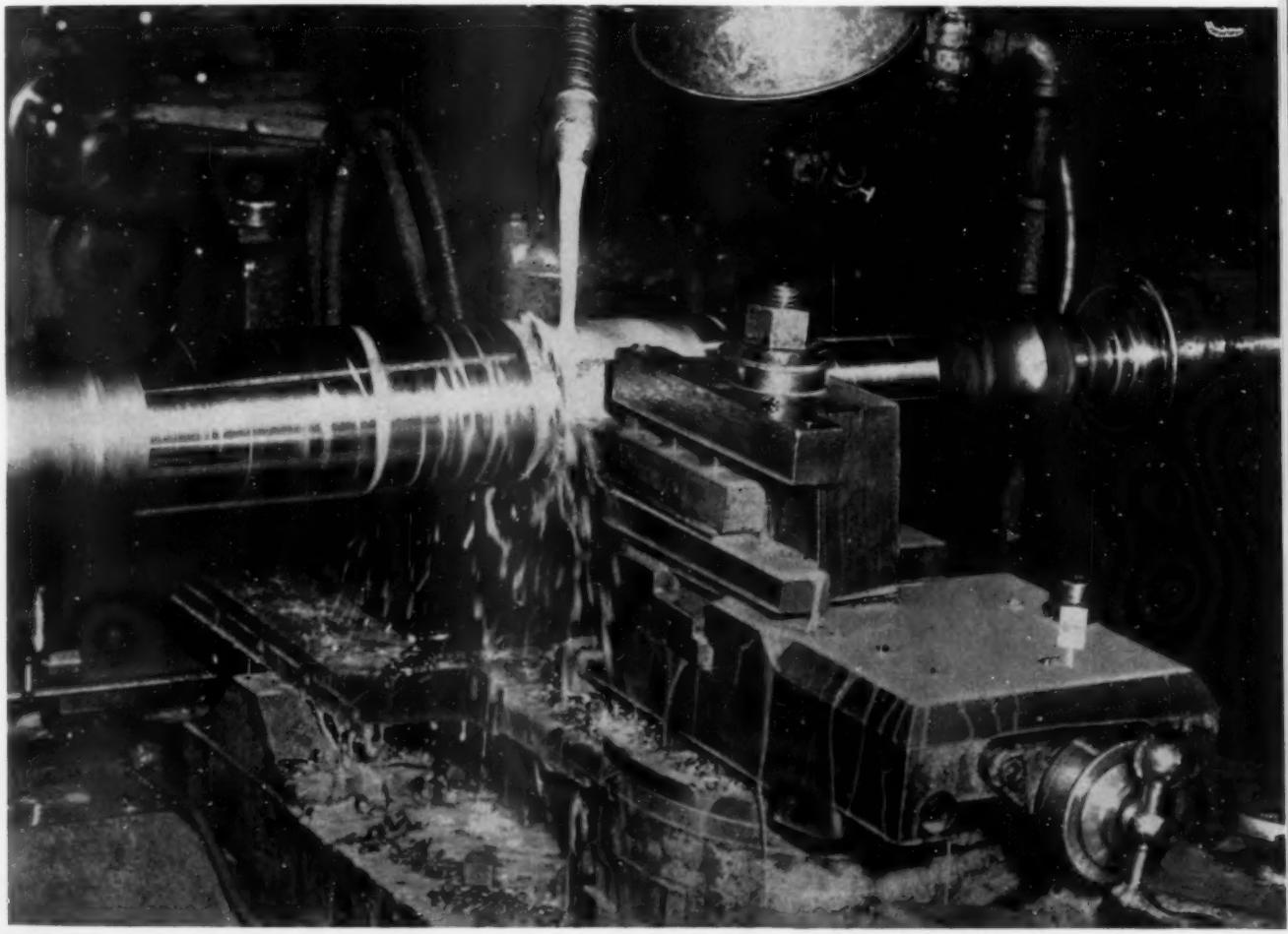
AUTOMATIC GAGING and sorting of transmission pinions in connection with a honing operation segregates parts into undersize, oversize and acceptable parts. Red, green and white approach warning lights visually indicate the dimensional qualities of the parts as they are being gaged. A visible dial air gage is inserted in the machine control pneumatic circuit to provide a constant indication of the exact size of the workpiece. The gaging units are electropneumatic type.

CHIP REMOVAL difficulties hampered broaching of internal splines in steel ball gear forgings at International Harvester Company's Louisville works. Chip loading of the broaching bar caused rough and inaccurate splines and runouts, requiring constant operator attention. A simple brushing fixture (close-up) doubled life of the broaching bar, reduced rejections 12 percent and improved quality and accuracy of splines. Installation was developed by company tool development engineers in cooperation with Osborn Manufacturing Co.



PUNCHING A PATTERN of 12 small holes concentric with a large access hole in a fuel tank reduced labor and material costs 94 percent at Pastushin Aviation Corp., Los Angeles. The special 35-ton hydraulic press was designed by company tool engineers for such jobs and was built of salvaged and surplus aircraft parts. Hand drilling, routing and deburring operations previously consumed over 10 minutes, and required jigs and fixtures, costing $800. The new horn press does the job in 10 seconds using dies costing $600.

DIFFICULT CUTS on scaly heat-treated 4340 steel forgings for landing gear struts were expedited by conversion to carbide tooling. Machine down time was decreased, tool life jumped 600 percent while the load on the grinding room dropped. Previously Menasco Mfg. Co., Burbank, Calif., was getting an average production of only one part per tool grind. Considerable tool overhang was necessary to clear a flange on the part. Speed was increased from 170 sfpm to 227 sfpm. Two roughing cuts from 0.60 to 0.200 inch, and a finish cut of 0.060 inch are taken. Feed is 0.010 ipr. A standard carbide tool was modified for this application. A 25-inch lathe with air tracer attachment is used on the job.



—Photo courtesy Carboloy Dept. of GE

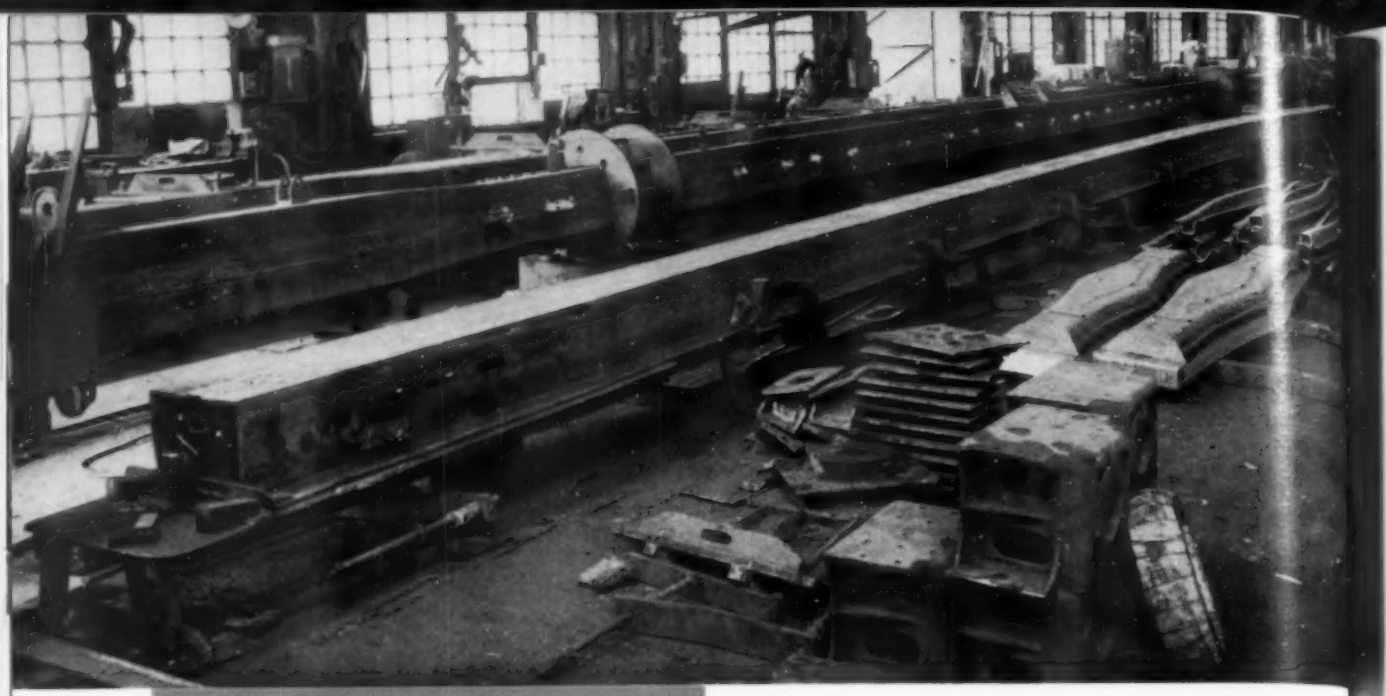


Fig. 1. Center seams on 85-foot passenger car center sills are automatically welded by the hidden arc method on the special jig in the foreground. The rollover jig is used when manually welding the stiffener plates and other fittings.

automatic welding of long seams

IN AN INDUSTRY accustomed to leisurely progress in manufacturing techniques, two major revolutions in 15 years could cause severe strains on manufacturing facilities. Within a 15-year span, the railroad industry has seen almost complete dieselization of motive power and wide application of welding in fabrication of rolling stock. This latter development has required welding of seams up to 85 feet long, and both developments have caused extensive changes in plant layout, machinery and personnel training.

The changes are readily apparent throughout the sprawling Altoona Works of the Pennsylvania Railroad, principal construction and repair center of the system, where approximately 13,000 are employed in the various fabricating and erecting shops. First major production welding operations there began back in 1936 when gondola underframes were assembled by manual arc welding instead of by riveting. In 1945 the first all-welded box car body appeared, followed shortly by passenger car bodies. Now, virtually all types of cars and frames are fabricated by welding.

One factor behind the steady extension of arc welding in car building has been the development of automatic machines and welding heads for traversing long seams at high speed. Modern machines give the desired penetration and produce a uniform high-quality weld bead requiring little if any finish grinding. The railroad company has adapted automatic hidden arc welding to a wide range of components, including car side and roof sheets, center sills, side sills, top chord members and hopper car tie bars. The Altoona Works operates four automatic Lincoln Electric Co. LAF-2 heads powered by 900-amp motor-generators and 14 heads served by 1200-amp generators.

Backbone of car underframes is the center sill, a hat-shaped section built up by welding a center seam along mating flanges of two Z-bar sections, *Fig.* 1. The two rolled sections making up the sill are high-tensile low-alloy steel. The principal concern when welding is to avoid distortion, both lengthwise and crosswise.

Distortion is prevented by a rugged jig to which the lower flanges of the Z-bars are clamped rigidly.

ertical plates, spaced at 6-foot intervals, provide positive stops for the upper edges of the assembled ill halves. These jig plates vary gradually in height rom center to ends so that the ends of the sill are pulled down 3 inches lower than the center. By thus cambering the beam and locking it firmly, distortion in a vertical plane is avoided. After the seam has been welded and the sill released from the jig, there is some springback, but a camber of about 1 inch remains to insure a level car under load.

This arrangement is used in welding 85-foot passenger car center sills, where the danger of distortion is great because of the length. At first the lower flanges were held down by driving steel wedges in slotted brackets along the lower edge of the jig frame, but this was later improved by the installation of air-operated clamps that have more positive action in holding the flanges.

Travel of the welding head along the seam is about 40 inches per minute and agglomerated flux is deposited continuously over the arc, doing away with smoke and arc glare, and protecting the weld metal during solidification. Excess flux is removed by a vacuum recovery unit traveling with the welding heads. A nozzle for the recovery unit is positioned some distance behind the electrode and squarely in the path of the flux pile.

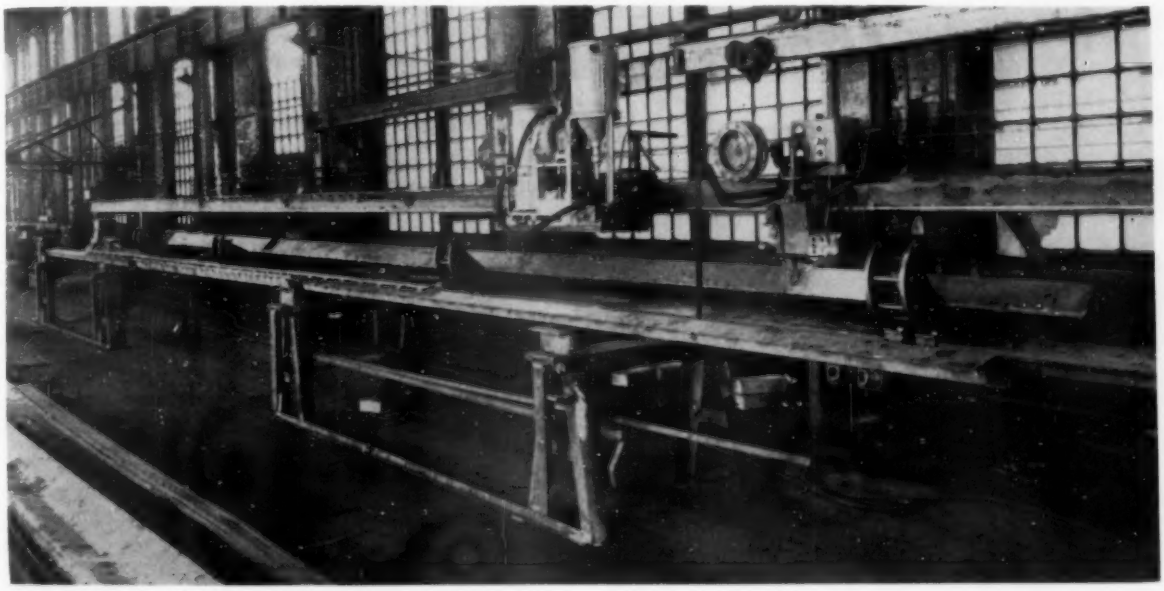
A novel arrangement for backing up the weld on the inside of the hat section was devised by the supervisor of welding and his staff. Originally this was done by laying a fire hose underneath the full length of the seam and inflating it with air. This method proved unsatisfactory because of eventual deterioration of the hose from the heat. Contact with the seam was poor, particularly if there were any slight irregularities in the rolled flange. Consideration was given to a copper back-up bar, but again it would have been difficult to insure contact along the full length, especially in view of the camber imposed on the piece.

To overcome these shortcomings, the upper edges of the vertical supporting plates on the jig were notched out to receive a thin-gage steel trough 4 inches wide and 2 inches deep so that the upper edges of the trough would be just flush with the plate edges. This trough bends easily to the necessary camber. It is filled heaping with welding flux of the same type as that used in the welding head, and the work is then pulled down against it. The granular material follows any irregularities in the flanges and fills any spreads in the seam, usually present because of rolling variables.

This arrangement provides an ideal back-up for the welding head since a minimum of 50-percent penetration by weld metal is acceptable. There is little need for replenishment of the flux in the trough for succeeding welds. Any slag formed adheres to the underside of the seam and does not contaminate the flux in the trough.

Sills vary from $12\frac{13}{16}$ inches to $13\frac{1}{16}$ inches in depth and the cross-sectional areas vary. The width across the hat section must be held to within $\frac{1}{16}$ inch. This is done by means of steel gage plates slipped over the section during setup. No edge preparation is necessary, even though there is often a slight reverse bevel or rounding on the mating edges as a result of mill rolling practice.

Fig. 2. Two lengthwise fillet welds are made to join the two sections of this boxcar top chord member. The automatic welding head rides on a beam above the work, receiving power through a shoe-type trolley contacting the three wires along the building columns.



When the center seam has been welded, only one pass being required, the sill is transferred to rollover jigs, visible in *Fig.* 1, for manually welding $\frac{3}{8}$-inch stiffener plates inside the section and attaching end plates, bolster plates and other pieces making up the complete assembly. Finally, it is moved to the underframe jig where cross bearers, diaphrams, stringers and other elements are manually welded on to make a rigid base for the car.

Another example of fast machine welding of long seams is shown in *Fig.* 2. This is an automatic Lincoln LAF-2 hidden arc head traversing the seam in a 50-foot long freight car top chord member. The member is formed from two specially rolled $\frac{3}{16}$-inch plates, manually tack welded and then fillet welded by machine along the joints at either side. The chord is mounted in a rollover jig with split circular supports that can be swung open to permit passage of the welding head.

The head, together with its flux recovery unit, travels on an I-beam above the work. Contact with the power supply is made through trolley shoes on the welder which contact three wires carried on the building columns alongside. This avoids the nuisance of long lengths of welding cable being dragged back and forth across the floor. The head travels at 45 inches per minute. Welding wire is $\frac{7}{32}$-inch diameter mild steel.

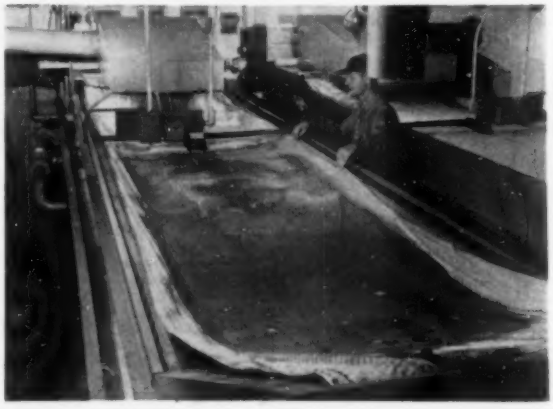
Grinder Efficiency Climbs Through Centralized Coolant System

Introduction of a central coolant system, incorporated in the plant design, has made high the efficiency and quality of grinding operations at Warner & Swasey's new parts plant. The system, heart of which centers in a below-floor filtering and reservoir installation, serves all grinding machines in the plant. Coolant is piped under pressure from two large filtering tanks. Spent coolant containing work chips and abrasive particles is discharged from the machines into a covered floor channel to flow by gravity back to the filtering tanks. Continuous rolls of 48-inch wide filtering paper feed through tanks to strain contaminating particles from the fluid. Clear coolant is withdrawn from the bottom of the tanks and pumped to machines at a maximum relief valve setting of 25 psi.

The system, which now serves 28 grinders but has an ultimate capacity for supplying 40 machines, offers multiple advantages to the plant. Primarily, it avoids downtime and nonproductive labor required for frequent sump cleaning which is associated with units for individual machines. Further, the central unit assures a constant supply of clear coolant of a controlled mixture to achieve high work quality and fine finishes. With the centralized control, waste is practically eliminated —no throw-away is involved as might be true when mixtures grow rancid due to temporarily idle machines. Finally, the system permits a uniform coolant temperature to be consistently maintained, which simplifies the job of accurately holding sizes on the machines.

Warner & Swasey anticipates the entire installation will pay for itself in two years. They will save the cost of two workers, who would otherwise be needed for sump cleaning; and also will make profitable use of the machines during the periods when they otherwise would be idle for that cleaning process.

Spent coolant returning from grinder discharges into filtering tanks. Filtering paper strains out contaminating particles. Fresh coolant is withdrawn from bottom of tank for delivery through pressure piping back to machines.



cold extrusion

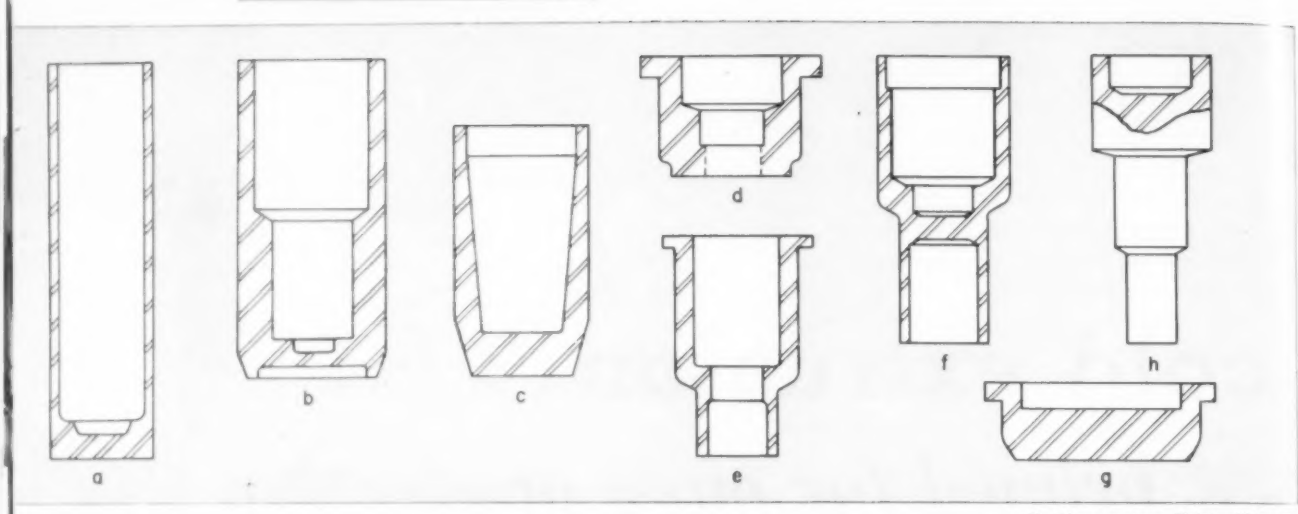
. . . primed for mass production

By Ralph H. Eshelman
Associate Editor

WHEN COLD EXTRUSION of steel was first imported from occupied Germany, ordnance officials were highly enthusiastic over its potentialities. The process has lived up to expectations in military production such as *Fig.* 1, but its promise for civilian output is largely unfulfilled. Production executives and tool engineers appear hesitant to dig for the pot of gold at the foot of this rainbow. Perhaps they are fearful it is a mirage. More likely they are waiting for the charting of unknowns of application and tooling, as each new application presents problems which must be solved largely by experimentation. Thus, the foremost question in each new tooling setup is whether it will prove out and the amount of development work that will be needed. The substantial investment required in specialized equipment has undoubtedly caused many firms to go slow in adopting the method, despite the well publicized advantages of great material savings and process simplification. Coupled with the problem of initial large investment is the question of what to do with equipment displaced.

Despite these difficulties, civilian applications are increasing with the benefit of ordnance experience. Types of parts suited to cold extrusion in addition to the well-known shell and rocket head shapes, include long tubular bodies, and a variety of other

Fig. 1. Operator removing part from forward extrusion die. This part was first formed to cup shape by backward extrusion at Gibson Refrigerator Co.



—Sketches courtesy Heintz Mfg. Co.

—Courtesy E. W. Bliss Co.

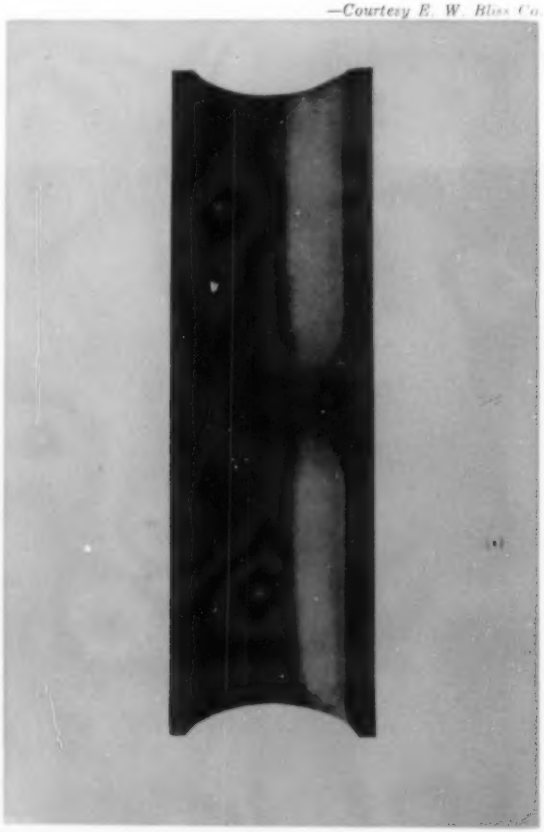


Fig. 2. (above) Types of shapes adaptable to cold extrusion: *a* long tubular body; *b* thick or thin wall cylinder with varying bottom thickness; *c* tapered wall cup (on inside or outside diameter); *d* flanged and pierced cup; *e* complex cylinder using forward and backward extrusion; *f* variation using double backward extrusion; *g* solid cap; *h* solid stepped bar.

Fig. 3. (left) Wrist pin formed by double backward extrusion from coined slug. Cross section shows metal flow.

cylindrical parts, such as shown in *Figs.* 2 and 3. Square or rectangular cups can also be produced, *Fig.* 4, particularly in softer metals, such as aluminum, brass and copper. While these types of parts may not exhaust the possibilities for cold extrusion, more complicated and unsymmetrical parts await further development and experience.

Contrary to the general impression, most of the parts shown in these figures require a series of press operations of which actual extrusion is only one, though the most vital. For instance, the part being formed in *Fig.* 1, requires, in addition to the backward and forward extrusion operations, sizing, coining, drawing and nosing, *Fig.* 5. The extrusion operations themselves are classified either as backward or forward extrusion, depending on the path of metal flow, though there are also combinations of the two. Regardless of the type, the process consists of causing unheated metal to flow through an orifice formed by punch and die, giving the part its shape. Though the blank is loaded cold, severity of the operation causes workpiece and tool temperatures to rise to about 500 F. While nonferrous metals can be worked with animal fat oils, greases and waxes, both a phosphate base coating and a lubricant are essential with steel. Annealing and recoating are frequently necessary when a series of cold forming press operations are used to bring the part to finished form as in ordnance work.

Backward Extrusion

In backward extrusion the direction of metal flow is up around the punch, that is, backward to

direction of punch travel. A typical backward extrusion operation is that performed in forming a cup shape from a round slug, as shown in *Fig.* The tool assembly drawing for this operation is illustrated in *Fig.* 7. These two figures provide an example of tool design for backward extrusion. The die is closed on the bottom by the knockout slug. The thickness of the cup is determined by the clearance between the punch and the die during the stroke. The die ring is press fitted into a 4-foot retainer ring. Sometimes a hardened insert or carbide insert is used between the die and retainer ring. The knockout block which rests in the lower part of the die has a height sufficient to prevent cocking during ejection of completed parts.

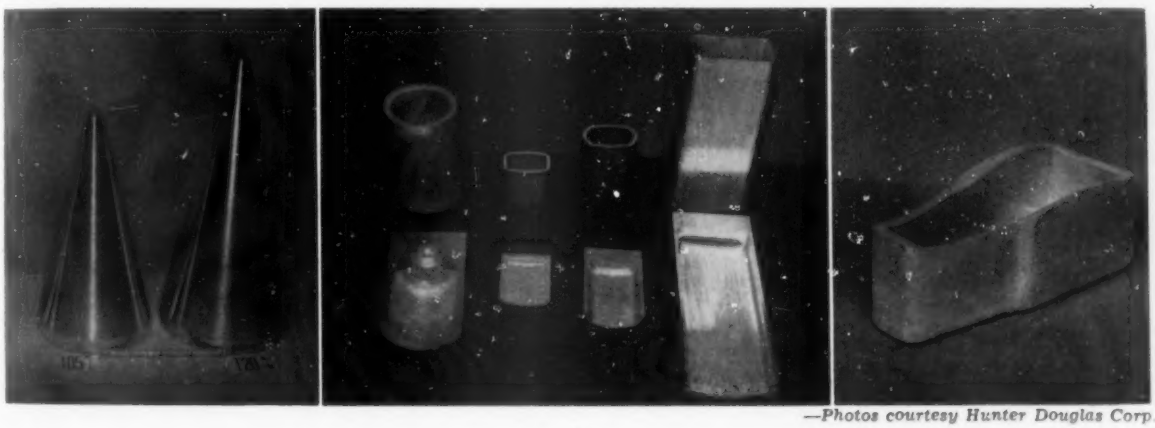
The shape of the punch nose is a subject of considerable controversy. According to most authorities, a small angle gives best grain flow and requires less pressure, but horizontal stresses are higher with a low die angle. A compromise is usually made at about 125 to 130 degrees. Punch and die are highly polished at least 10 microinches to reduce frictional resistance and danger of cracks and fractures forming in the workpiece. Final finish on tools should be given to align with metal flow. Design of tooling is vital in holding stresses to a reasonable value. Length of bearing surface should be short to minimize resistance to metal flow. This may be accomplished by means of a land or relieving the punch above the bearing area as shown in *Fig.* 6 and designs *a*, *d* and *f*, *Fig.* 8. The further the punch shape deviates from the ideal, the less is the reduction of area that can be secured because of the higher stresses. In fact, it has been found better to secure the final desired shape in subsequent operations such as ironing, drawing, coining or other forming operations than to try to utilize maximum reduction. Often failure in extrusion is due to the fact that an attempt is made to bring the part to final form in too few steps. Usually the limitations on tool design are much less stringent in nonferrous operations because of much lower stresses involved.

Forward Extrusion

As in backward extrusion, material is plastically deformed to the desired shape by compression. The difference is, however, that the metal is pushed through the orifice in the same direction as the movement of the punch. Long tubular shapes or solid stepped shafts, such as illustrated in *Fig.* 2, are typical of forward extrusion. The diameter of the die is chosen to accommodate the preformed slug or cup with tolerances for locating. The bearing area of the die, *Fig.* 9, is the outside diameter of the extruded part. The die is relieved below the bearing to reduce frictional resistance. Additional guides may be provided to maintain straightness of the part as it flows ahead of the punch.

In forward extrusion, metal flows at a faster rate due to its change in cross-sectional area. Typically, the formed part has a flange or press rest where the punch grips it against the die.

Fig. 4. Parts formed of high strength aluminum alloys by extrusion indicate greater latitude of shapes possible in nonferrous alloys, including unsymmetrical shapes.



—Photos courtesy Hunter Douglas Corp.

Tooling for Cold Extrusion

Since extrusion is the most severe of all presswork and loadings are extreme, tool design and materials are critical factors. *Fig.* 10 shows the stresses involved and the practical range for cold-working for steels. A similar chart for some non-

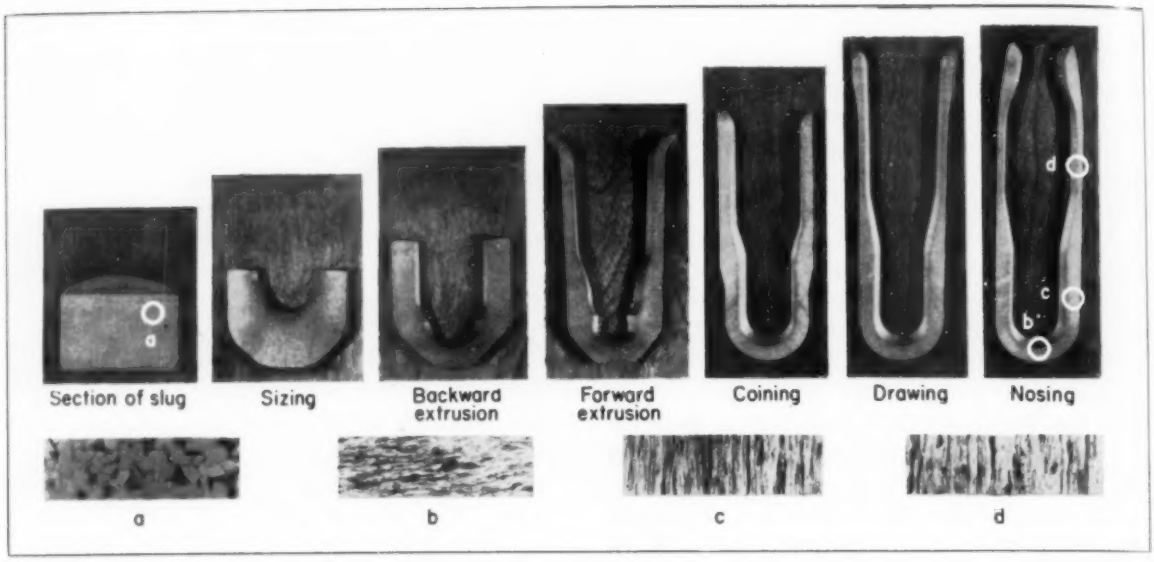
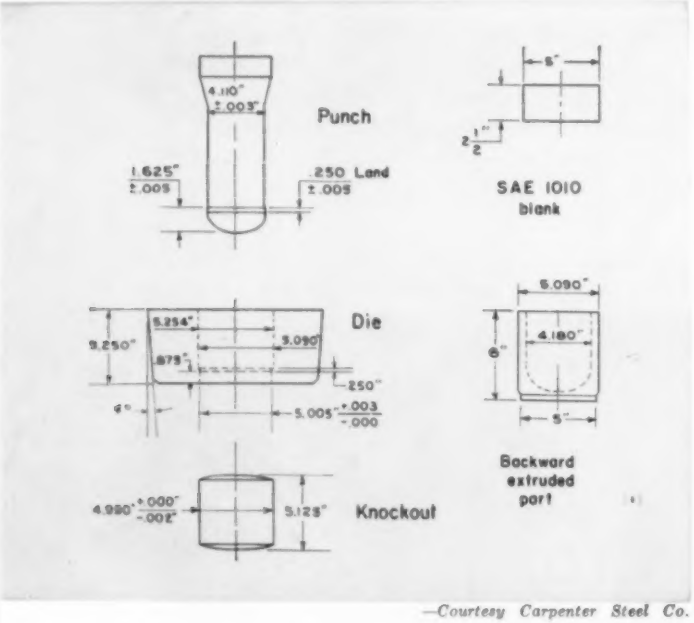


Fig. 5. (above) Deep-etched sections show steps in cold forming 75 mm shell at Gibson Refrigerator. Slug is carefully inspected and processed to remove defects. Corresponding photomicrographs (100X) indicate microstructure before and after forming.



—*Courtesy Carpenter Steel Co.*

Fig. 6. (left) Sketch of tooling for extrusion of rocket nose; (right) blank and extruded cup. Operation requires two draws, restrike and nosing.

ferrous metals commonly extruded is shown in *Fig.* 11.

Because of high loadings, the tools should be drawn or stress relieved at fairly frequent intervals to offset surface fatigue. Carbides are being tried for various portions of the tooling to overcome these problems. Punches of carbide have been tested experimentally and have been reported in production on special jobs. Another recommended use for carbide is for inserts. The inserts may be die walls in backward extrusion or bearing areas and guides in forward extrusion, or other points of great abrasion and pressure.

While the problem of finding satisfactory tool materials is complex, specific applications have been successfully developed. For example, the first materials used for the tools shown in *Fig.* 6 were unsatisfactory, giving a production of only about 3000 pieces. A high-speed steel 18-4-1 was found satisfactory for the punch producing over 14,000 pieces to date. A tool life above 30,000 pieces is considered good.

This punch was hardened in a salt bath from a temperature of 2350 F and double drawn at 1050 F to a hardness of Rockwell C-62 to 64 and given a liquid nitride treatment. A surface hardness of 72 to 74 Rockwell C was developed to a depth of about 0.001 inch. A special heating jacket has been prepared to hold the punch at operating temperature when the press is idle. The knockout is also made of high-speed steel of the same hardeness.

A manganese-chromium-molybdenum nondeforming, air-hardening die steel has been found to give good life in the ring die. So far, 23,000 pieces have been produced on the ring and it is still in operation. The hardness of the ring die is Rockwell C 58 to 60, secured with the standard heat treatment. One of the qualities sought in this steel was its uniformity of hardness from surface to center as failure of the ring was found to occur when strain exceeded elastic limit of the steel. In

this application the ring die is press fit into a four-foot diameter hardened retainer ring of Rockwell hardness C-34 to 36. Force exerted in the operation stretches the die so that the ID increases beyond the tolerance requirements, which must be held to 0.010 inch of specified wall thickness. Cold working of the slug in this operation increases hardness of the formed part to Rockwell B-90 from Rockwell B-60 in the slug.

There are two types of extrusion dies: open and closed. The metal does not completely fill the cavity in open dies while it does in the closed die, *Fig.* 12. Closed dies are usually relieved at one or two places to allow for variations in blank size.

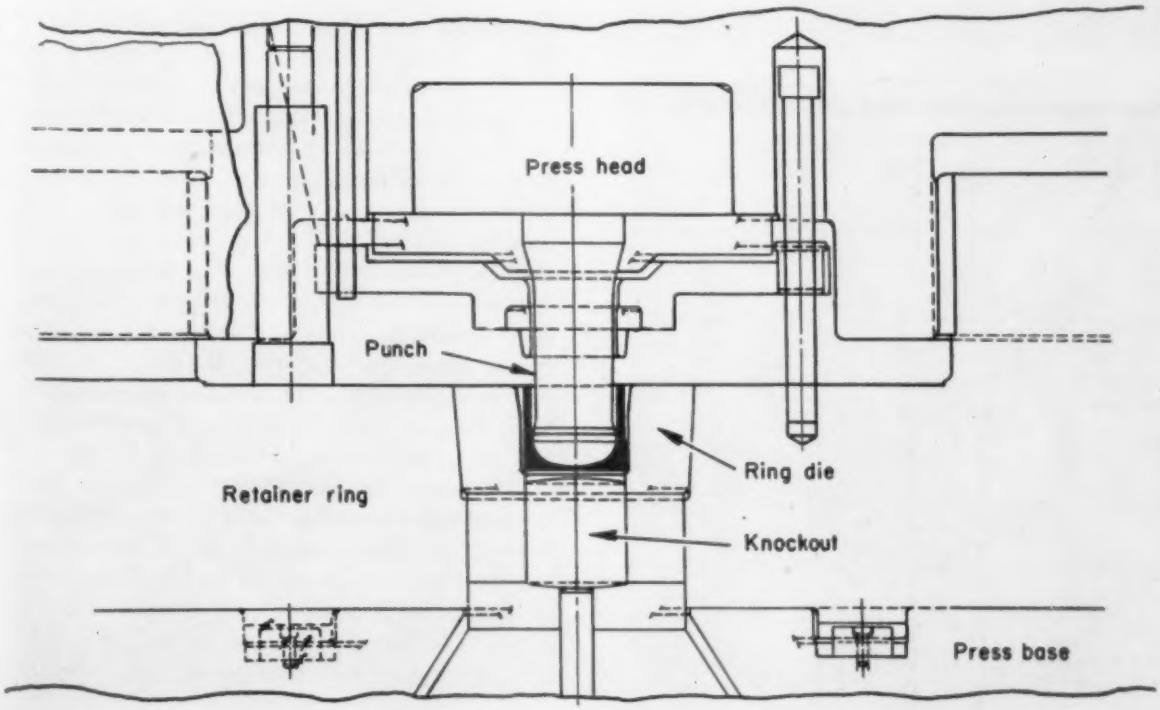
Pressure needed for an extrusion operation depends on the material yield point and friction or resistance to flow due to the die. To determine the tonnage required a study must be made of the conditions. At low speed and little restriction to flow the press load can be based on the yield point after work hardening. At high speed and restricted flow, press load may jump to three times the finishing yield point. Pure metals can be worked at lower pressures than alloys. In alloys, certain groups of molecules tend to key the slip planes together, making movement difficult, according to E. V. Crane, Chief, Special Engineering, E. W. Bliss Co.

Surface Coatings and Lubrication

Improvement in lubrication methods was one of the principal factors in making cold extrusion of steel feasible as a production process. While proper lubrication will not overcome faulty tool design, it will go a long way towards facilitating operations and will permit a greater latitude in design than would otherwise be possible. This is indicated by the data given in TABLE 1, which shows that galling and welding between die and workpiece would occur without lubrication. It can also be inferred from the table that higher percent reductions and heavy press loadings are made possible by the lubrication.

The method of lubrication found most satisfactory consists in surface coating the blank with zinc phosphate, then adding a reactive soap type lubricant to the treated surface. A comparison of results obtained with this method of treatment with uncoated steel and other treatments is shown in TABLE 2. Surface preparation is of primary importance in obtaining consistent results. Scale, sur-

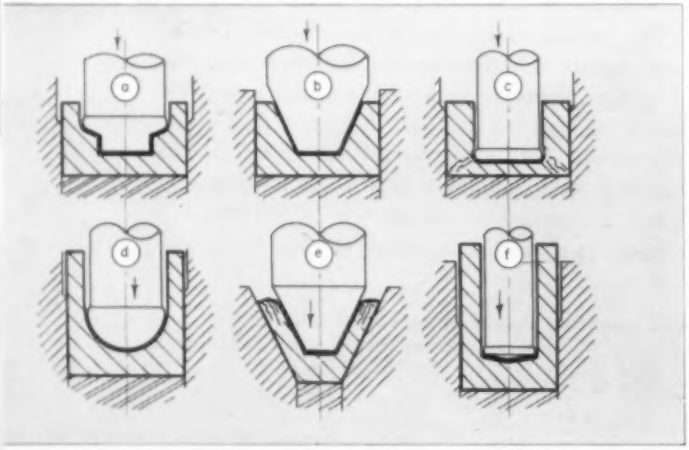
Fig. 7. Tool assembly drawing of typical backward extrusion operation on rocket nose.
—Drawing courtesy Pontiac Motor Div., G.M.C.



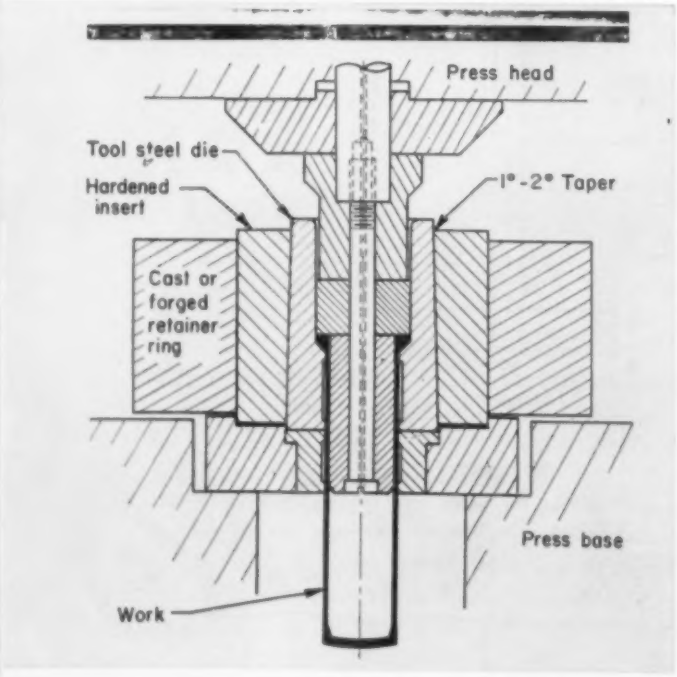
face oxides, grease and soil must be completely removed. To achieve best results, Parker Rust Proof, which has been connected with the original developments in this field, recommends the following cycle:

1. Alkali cleaning to thoroughly remove all oil and dirt
2. Water rinse, usually hot and overflowing, to completely remove alkali
3. Acid pickle to remove rust and scale and provide etch on the base metal. This is helpful in actual extrusion operation, obtaining optimum lubrication
4. & 5. Water rinses to insure complete removal of residual pickling acid and resultant iron salts
6. Phosphate coating bath, an acid zinc phosphate reacting with the surface metal, to produce a nonmetallic gray crystal and zinc phosphate coating integral with the base metal and blotter-like in nature
7. Cold water rinse to remove any residual acids and salts from the coating solution
8. Rinse, using a well-buffered medium compatible with the lubricant so that adsorption and reaction of the lubricant are complete
9. Reactive lubricant bath, dilute soap solution which in controlled reaction combines with the zinc phosphate coating, to form water insoluble metal soap, zinc stearate.

Fig. 8. Nozzle designs for backward extrusion illustrate problems: in *a*, *b* and *d*, stepped, tapered and round punches have been successful by restricting flow and increasing compression forces. In *c* and *e* splitting and crack have occurred because of faulty design. Design *f* represents more ideal design.



—Sketches courtesy Parker Rust Proof Co.



—Drawing courtesy Parker Rust Proof Co.

In production operations these steps are economically performed with an automatic continuous conveyor system. As indicated by the data shown in TABLE 1, unit pressures can rise rapidly with deviations in lubrication. Optimum lubrication is desirable in development stages to determine the maximum cold work that can be accomplished in each step, to minimize number of operations and simplify tooling requirements.

Unit pressures are lower in extrusion of aluminum but lubrication is still critical. A zinc phosphate coating available specifically for aluminum will extend the scope of extrusion of the alloys of this metal.

Materials and Their Improvement

While extrusion of steel has been limited largely to low-carbon types such as 1010 or 1012, the physicals resulting from the extreme cold working afford many of the advantages of more expensive alloys. A comparison of tons per square inch pressure required for some of the various common steels is shown in TABLE 3. This is experimental data obtained to show the relation between reduction in area and length of billet for extruding similar length parts. Higher alloys such as 4130 have been worked by cold extrusion experimentally. Tools have not yet been developed for satisfactory production applications in these higher alloys.

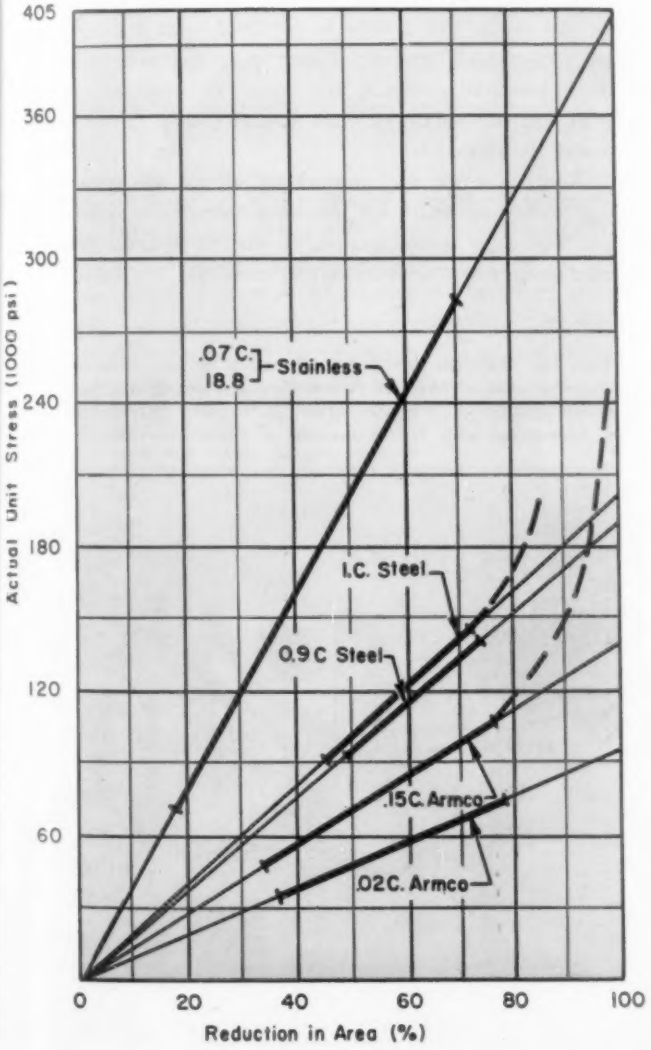
In Germany aluminum-killed low-carbon steels spheroidized annealed are used for extruded parts. A group of photomicrographs taken from the slug and the finished piece, shown in *Fig.* 5, depict the effects of cold forming upon the structure of the metal. The material used is, in this case, SAE 1018 aluminum-killed shell-quality steel. The re-

Fig. 9. Forward extrusion tooling assembly.

ted physical properties are shown in TABLE 4. he conclusions of Gibson Refrigerator engineers e that, due to the thorough kneading effect of e cold forming process, the original approximaely equilateral grain structure of the hot rolled ar steel has been transformed into a highly directionalized fibrous structure. This together with he work hardening effect of cold forming, has caused a considerable increase in all tensile properties, with the exception of elongation which, despite a decrease of 40 percent as compared with that of hot rolled bar steel, is still ample for most engineering purposes. With the commonly used annealed low-carbon steels, ranging from 0.10 to 0.15 percent carbon, the yield point can be increased from 35,000 to above 100,000 psi.

The continuous fibrous character of the formed metal is one of the inherent characteristics of extruded parts which was established in early tests by leading German authorities, such as Hauttmann and Pessl. This is evident even in low magnification of sections such as shown in *Fig.* 3. Improved physical properties are also obtained in nonferrous alloys such as aluminum. Because of the growing body of technology relating to extrusion operations, many of the high-strength, heat-treatable alloys of aluminum are now used. The age hardening tendency of some aluminum alloys poses no particular problems in forming but may set a time limit on subsequent operations.

Fig. 10. Tentative curves showing commercial cold-working range and rate of strain-hardening for different steels. Heavy line indicates the workable range. *—Chart courtesy E. W. Bliss Co.*



Press Equipment

While standard press equipment can be used, especially on lighter extrusion work, specialized equipment is desirable. There has been considerable controversy over the merits of the mechanical press as against the hydraulic press in extrusion work, with proponents claiming success with each type. The mechanical press seems to be preferred where it provides sufficient capacity. Advantages cited for it are: faster production, less frequent and simpler maintenance. Because of slower follow-through, the hydraulic press seems to cause the material to work harden requiring greater pressures. For loads above 2,000 tons hydraulic presses are generally used because of the longer stroke available and economic advantages.

Presses for extrusion work are designed to handle load concentrations with minimum deflection to obviate this cause of tool breakage. Slides should be guided by closely fitting gibs to keep the punch well centered and to minimize eccentricity. In addition, the gibs should be long enough to prevent cocking of the slide and punch due to any eccentricity in loading. Because of the heavy load on the punch, bending stresses must be avoided.

Presses designed specifically for cold extrusion work are provided with oversize drives. The torsional elements, gear shafts,, clutch, etc. need to be about three times as strong as in a conventional press of the same size, since the punch must often deliver full tonnage high in the stroke without weakening at the bottom of the stroke. For this reason flywheel and motor must also be oversize, often as much as four or five times.

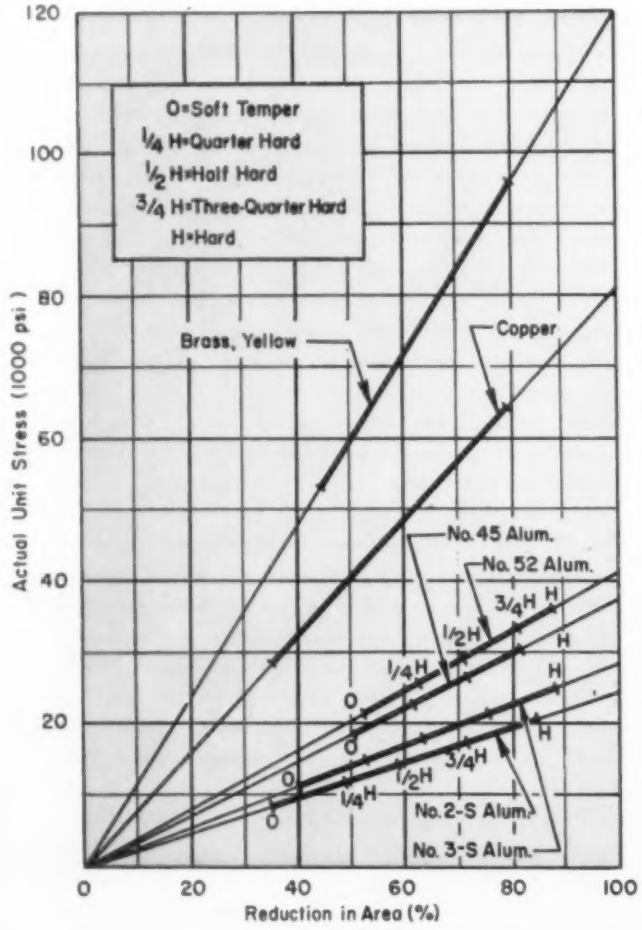
On aluminum and other softer metals, mechanical crank or knuckle presses are commonly used. While tonnage requirements are considerably lower than for steel extrusion, the press requirements are similar, as a long stroke is frequently required for the parts produced.

Future of the Process

Civilian applications, particularly automotive, are often small pieces which lack the opportunity for the extensive material savings that have been possible on projectiles. Savings in scrap, coupled with use of low cost material, do however, offer attractive possibilities. If a part involves a shape that is difficult or time-consuming to machine, but

Fig. 11. Tentative curves showing commercial cold-working range and rate of strain-hardening for some nonferrous metals. The heavy line indicates the workable range.

—Chart courtesy E. W. Bliss Co.



can be press extruded, the process offers an obvious advantage.

Greatest advantage can be secured from the process by designing parts specifically for it. This may require a compromise with a part designed for production by another means. It may be possible, for instance, to produce a part by cold extrusion by making small changes in radii or angles. Cold extrusion also affords the opportunity of redesigning a subassembly to combine several parts into one, resulting in a stronger and better component (ref. THE TOOL ENGINEER, August 1954, page 63.) The process ordinarily would not replace automatic screw machines on small parts produced in one setup, especially if metal removal is not excessive. Where multiple machining and forming operations are involved and large quantities of metal removed, a part may be a good candidate for cold extrusion.

Potentialities are also great for aluminum and other soft metals. Parts can be produced at speeds above 4200 pieces per hour. Parts with internal features, formerly impractical to produce or so complex that they could only be made by combinations of milling, drawing, machining, casting and assembling operations, can be produced at low cost with one stroke. The following principles can be used to determine whether a part should be made by extrusion: (1) base thickness is considerably greater than sidewall thickness, (2) base includes bosses, lugs, projections or recesses, (3) wall thickness must be increased at the open end of the shell, (4) a tube is required with a flange or heavy wall section at one end, (5) sidewalls have internal, external, transverse or longitudinal ribs and (6) length of plain shells exceeds 1½ to 2 times the diameter.

Tooling costs for nonferrous alloys are lower for extrusion than for drawing, especially when the last rule is considered. Costs, of course, are increased when unsymmetrical elements are intro-

Fig. 12. Multiple extrusion operation forms complex gear or cam shapes in closed die: *a* coined slug has metal gathered at center area; *b* forward extrusion; *c* indenting with rising punch; *d* shapes developed.

—Drawing courtesy Parker Rust Proof Co.

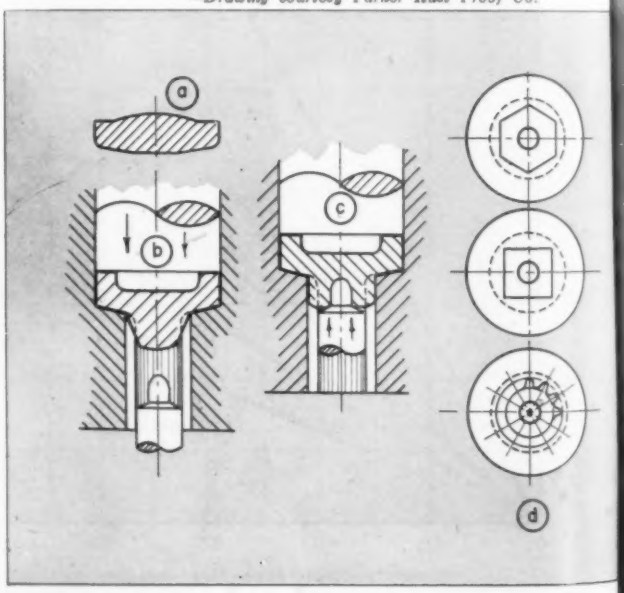


Table 1—Effect of Surface Condition on Press Loads (Forward Extrusion)

Surface Condition	Reduction In Area (%)	Unit Pressure (psi)	Remarks
Bare	20	296,000	Heavy Pick-Up All Specimens
Phosphated			
Thin	20	270,000	———
Thick	20	193,000	———
Bare	40	232,000	Heavy Pick-Up All Specimens
Phosphated			
Thin	40	216,000	———
Thick	40	208,000	———
Bare	60	———	Unsuccessful
Phosphated	60	210,000	Pick-Up All Specimens
Thin			
Thick	60	198,000	———
Bare	85	———	Unsuccessful
Phosphated			
Thin	85	———	Unsuccessful
Thick	85	260,000	———

Data courtesy Clearing Machine Corp.

Table 2—Apparent Coefficient of Friction for Various Phosphate Coatings (Forward Extrusion)

Unit Pressure (psi)	Apparent Coefficient of Friction — Bare Metal (μ)	Zinc Phosphate (μ)	Manganese Phosphate (μ)	Cadmium Phosphate (μ)
10,000	0.108	0.013	0.085	0.034
50,000	0.068	0.032	0.070	0.069
100,000	0.057	0.042	0.059	0.055
200,000	0.070	0.043	0.066	0.055

Note: Lubricated with dilute sulphonated tallow emulsion, 1 hour at 160 F.

Data courtesy Clearing Machine Corp.

duced because of the greater care required in the tool design and additional rigidity necessary in the press. Also production speeds are usually lower and shorter tool life can be expected. As an example of tool and die costs in nonferrous work, at least four draws would be required if it were possible by usual deep-drawing methods to produce a simple, round can two inches in diameter with an over-all length of 16 inches. A four-station progressive draw die would cost at least $2,800. The same part can be produced by extrusion at a total cost of less than $900. Further, differences in production rates and scrap savings usually favor impact extrusion over deep drawing or other multi-step processes.

While it is difficult to compare cold extrusion of

Table 3—Pressures to Forward Extrude Various Steels (in tons per square inch of displaced metal)

Reduction in Area (%)	Length of Billet (inch)	C1010		C1020		C1040		A-4615		A-5120	
		Start	End	Start	End	Start	End	Start	End	Start	End
20	6.5	171	49	162	56	243	160	141	59	206	92
40	6.31	169	115	172	122	183	158	178	140	192	151
60	4.25	139	96	156	118	—	—	191	137	186	145
70	3.12	125	101	141	120	—	—	—	—	—	—
75	2.62	156	137	—	—	—	—	—	—	—	—
80	2.12	121	114	—	—	—	—	—	—	—	—

Data courtesy Clearing Machine Corp.

Table 4—Changes in Physical Properties (for part shown in *Fig.* 5)

Section of Part (in Fig. 5)	Identication of Section	Average Physical Properties				
		Rockwell Hardness	Yield Strength (psi)	Ultimate Strength (psi)	Elongation (%)	Reduction of Area (%)
a	C1018 slug, Al-killed 4" dia. bar steel, hot rolled.	60	32,000	60,000	25	40
b	Interior of shell base center.	100	———	———	—	—
c	Rotating band seat groove area.	95	90,000	95,000	15	55
d	Thin walled shell body.	98	95,000	100,000	14	50

Data courtesy Gibson Refrigerator Co

steel parts with other processes based on present experience, it is evident that tooling costs limit the process to mass production operations. When full advantage is taken of the process, however, material and process savings will usually give it a competitive edge. Because of the mirror finish required on the die and punch, the part finish is of superior quality, satisfactory for many commercial applications. Parts can be worked to tolerances as close as 0.005 inch in production, and even closer on small diameters.

In extrusion operations, billet preparation is a substantial item. Phosphate coating itself is cheap, often less than half a cent per operation. The press operation is also low, seldom costing more than one cent per operation. Cost of process (low temperature) anneals is reported about a half cent per piece. If required, complete anneals would run higher. Often other operations used in the process, such as drawing or coining, can be performed without annealing or recoating. Finishing operations, such as grinding or threading, are additional but usually less than by alternative methods.

Backward extrusion operations are being commonly done to about 2½ times punch diameter, being limited by column action on the heavily stressed punch. The length extruded on forward operations may be up to twenty times diameter though straightness may be a problem. Limitations on use of high-carbon and alloy steels because of rapid work hardening of alloys and of present tool materials, will probably be overcome to some extent by research, esperially in the automotive field. Considerable research is also being conducted in the military field, both at private companies and in government facilities. Further development and experimental work is under way on extrusion of aluminum and magnesium especially in the aircraft field which is interested in some steel alloys also.

For blanks, military production has used sawed billets with flaws and imperfections removed. In civilian production other methods will be required, especially on small parts, to compete economically with screw machines. Cold bolt headers, using extrusion principles, have been in operation for some time.

Altogether cold extrusion offers remarkable potentialities for the tool engineer bold enough to exploit them. Experience to date has been sufficient to establish the opportunity available in this field. According to reports, both automotive and aircraft companies will be in production on some parts within the year. Other applications can be expected to multiply rapidly as production men generally become more familiar with the process.

Acknowledgments

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span measurement of gear teeth

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THE SPAN SYSTEM of measurement, sometimes known as block measurement, or measurement over two or more teeth, has universal application to spur or helical gears and a degree of accuracy that makes it almost ideal. Measurements can be made while the gear is in the machine and accuracy is not affected by outside diameter errors, including runout. No particular skill is required and disagreement between inspectors and operators is virtually eliminated.

With this system, no master gears, holding fixtures, pins or balls are required. A single micrometer of one-inch range can handle work of several inches pitch diameter range. A small caliper can measure a large gear with ease.

The system is based on the geometric fact that any normal to any involute tooth surface will be contained in a plane tangent to the base cylinder. Two parallel caliper jaws will tangentially contact oppositely facing tooth profiles in a manner similar to the diameter measurement of a cylinder and with a similar feel. No edge contact is ever obtained under correct measuring conditions. The measurement is directly related to the thickness of a single tooth (or the backlash the gear contributes to the assembly) inasmuch as the measured distance is composed of a number of pitches plus the thickness of a single tooth, *Figs.* 1 and 2.

The equations that follow are applicable to all spur and helical gears of all proportions and under all conditions of operation. Any helical gear equation requiring a trigonometric function of the helix angle is applicable to spur gears by using the trigonometric function of 0 deg. Definitions of symbols used are listed in the Nomenclature.

Mathematical equations for transverse pressure angles, which are used without proof, are as follows:

$$\varphi_t = \tan^{-1} \frac{\tan \varphi_n}{\cos \Psi} \quad \text{.....(1)}$$

$$\varphi_k = \cos^{-1} \frac{C \cos \varphi_t}{C_k} \quad \text{.....(2)}$$

Number of Teeth in Span

To cause caliper jaws to tangentially contact the gear-tooth profiles, it is necessary to determine the number of teeth, or the number of pitches and half pitches, that should be included within the caliper span. (In initial computations, the tooth thickness is valued as a half of one pitch.) The number of pitches that should be included within the caliper span may be found from the following equation:

$$S = \frac{N\varphi_n}{180 \cos^2 \Psi} \text{ (approximately)} \quad \text{.....(3)}$$

This equation is not mathematically exact, but for practical purposes is acceptable inasmuch as results must be rounded to the nearest integer plus one-half. When the result of Equation 3 is an integer plus 0.8 or more, it is better to round up the result to obtain a better "feel". With short-addendum gears, it may be necessary to round down the result. The value of S is seldom critical, particularly when it is 3.5 or more, and liberties

Abstracted from a paper titled "The Span System of Measuring Involute Gear Tooth Size" presented at the 38th Annual Meeting of the American Gear Manufacturers Assn. and copyrighted in 1954 by the author.

Symbols and Nomenclature

B_n = Backlash normal to tooth surface, actual distance between profiles of mating gears.

B_t = Backlash in transverse plane, tangent to pitch circle.

C = Standard center distance.

C_k = Operating center distance = $C + \Delta C$.

ΔC = Change in center distance.

D = Pitch diameter of gear.

ΔD = Diameter increment or decrement applied to long and short-addendum gears.

$\Delta D_g, \Delta D_p$ = Diameter increment or decrement applied to gear and pinion respectively, nonstandard center distance operation.

M_1 = Span dimension without backlash allowance for standard spur and helical gears.

M_2 = Span dimension without backlash allowance for long and short-addendum gears operating at standard center distance.

M_3 = Span dimension without backlash allowance for gears operating at nonstandard center distance when each gear is enlarged or decreased in direct proportion to the number of teeth in each.

M_4 = Span dimension without backlash allowance for one gear operating at nonstandard center distance with another gear of standard proportions.

M_g = Span dimension without backlash allowance for short-addendum gear operating at nonstandard center distance.

M_p = Span dimension without backlash allowance for long-addendum pinion meshed with short-addendum gear and operating at nonstandard center distance.

N = Number of teeth in gear when consideration of mating gear is not required.

N_g, N_p = Number of teeth in mating gears (nonstandard center distance operation).

P_{nd} = Normal diametral pitch.

p_{no} = Normal circular pitch.

S = Number of pitches included within the caliper span.

φ_k = Working transverse pressure angle of gears operating at nonstandard center distance.

φ_n = Normal pressure angle.

φ_t = Transverse pressure angle (in spur gears, $\varphi_t = \varphi_n$)

Ψ = Helix angle at the pitch cylinder.

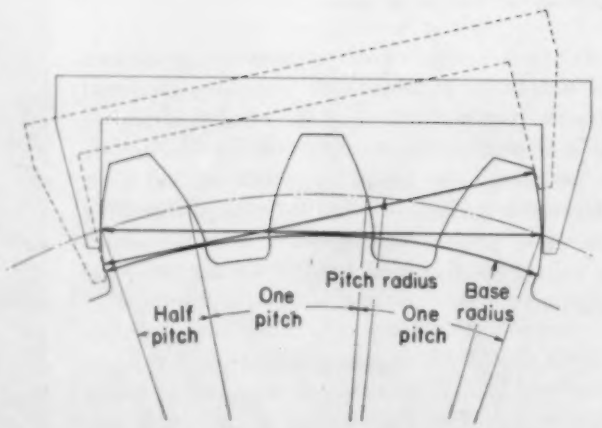


Fig. 1. The distance between opposing profiles of involute spur gears is always constant and equal to the length of the base circle arc, subtended below the spur gear teeth within the span of a caliper.

may be taken in its calculation when experience is accumulated. A nomograph for the determination of S within acceptable limits is shown in *Fig.* 3.

Span Dimension

Standard Gears: The basic dimension of the span for standard spur and helical gears meshing at standard distances can be found by:

$$M_1 = \cos\varphi_n \left[p_{no}\, S + \frac{N\ \mathrm{inv}\varphi_t}{P_{nd}} \right] \quad \ldots\ldots\ldots\ldots (4)$$

Involute functions of angles can be looked up in handbook tables or can be computed by using:

$$\mathrm{inv}\ \varphi_t = \tan\varphi_t - \frac{\pi\varphi_t}{180}$$

Long and Short Addenda: The span dimension of long and short-addendum gears having diameter changes of ΔD_p and ΔD_g equal and opposite, and which operate at standard center distances may be found from:

$$M_2 = \cos\varphi_n \left[p_{no}\, S + \frac{N\ \mathrm{inv}\varphi_t}{P_{nd}} + \Delta D\ \tan\varphi_n \right] . (5)$$

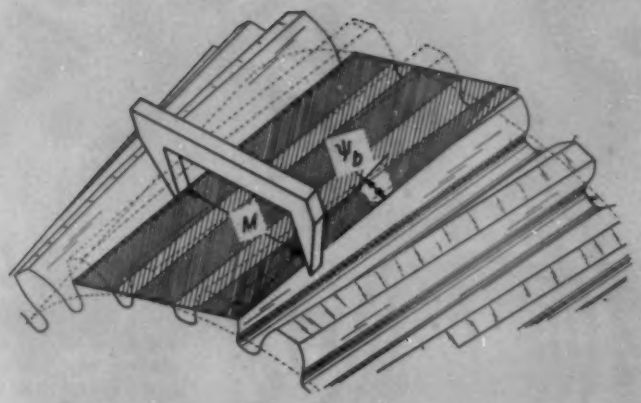


Fig. 2. The distance between opposing profiles of involute helical gears is always constant and equal to the length of the base cylinder arc subtended below the helical gear teeth and normal to the base helix angle.

It is important that the proper sign be applied to ΔD, i.e., plus for a diameter increment and minus for a diameter decrement.

Nonstandard Center Distances: At times, required gear ratio and center distance combinations cannot be achieved with standard pitches, and helix angles may be limited so that addendum increments or decrements must be applied to the mating gears which are then operated at nonstandard center distances. When the center distance is not standard, the working pressure angle is not the same as the nominal transverse pressure angle of the basic rack which causes an actual backlash between gear-tooth profiles, *Fig.* 4.

Proportional Modification: When mating gears are enlarged or decreased in direct proportion to the number of teeth in each, the span dimension may be found from:

$$M_3 = \cos\varphi_n \left[p_{nc}\, S + \frac{N\ \mathrm{inv}\varphi_3}{P_{nd}} \right] \quad \ldots\ldots\ldots\ldots (6)$$

One Gear Modified: If only one gear in a train has been enlarged or decreased by a diameter increment ΔD (which equals $2\Delta C$), the span dimension of that one gear can be found from:

$$M_4 = \cos\varphi_n \left[p_{nc}\, S + \frac{N_g \mathrm{inv}\varphi_t + (N_g+N_p)\ (\mathrm{inv}\varphi_3 - \mathrm{inv}\varphi_t)}{P_{nd}} \right] \quad \ldots\ldots (7)$$

Long and Short Addenda: To improve the performance of a gear set, the pinion may be enlarged more or less than the mating gear is decreased, and the pair may then be run at a nonstandard center distance. In this case, it is customary to also increase the thickness of the pinion by the amount of the backlash effect resulting from the nonstandard center distance operation.

The equation for the pinion is as follows:

$$M_p = \cos\varphi_n \left[p_{nc}\, S + \frac{N_p \mathrm{inv}\varphi_t + (N_g+N_p)\ (\mathrm{inv}\varphi_3 - \mathrm{inv}\varphi_t)}{P_{nd}} + (-\Delta D_g \tan\varphi_n) \right] \quad \ldots\ldots\ldots\ldots (8)$$

The equation for the gear is:

$$M_g = \cos\varphi_n \left[p_{nc}\, S + \frac{N_g \mathrm{inv}\varphi_t}{P_{nd}} + \Delta D_g \tan\varphi_n \right] . (9)$$

Note that the last term of Equation 8 contains the diameter decrement of the mating gear and by algebraic subtraction has a positive value.

Normal Base Backlash

If the gear actually measures smaller than the calculated size, the difference between the calculated size and the actual measurement is the normal base backlash which that one gear would contribute to the mesh. Normal base backlash is the actual clearance between meshing gear teeth and may be considered as the amount of oil space between mating teeth. However, when backlash must be controlled in a long gear train, as in some instrument or computer designs, it is necessary to convert normal base backlash to transverse pitchline backlash.

To convert normal base backlash to transverse pitchline backlash, the following equation is used:

$$B_t = \frac{B_n}{\cos\varphi_n \cos\Psi}, \text{ or } B_n = B_t \cos\varphi_n \cos\Psi \quad \ldots\ldots\ldots (10)$$

Instrumentation Required

Any suitable caliper may be used to measure external gears, splines or worms. Best results are obtained with a micrometer having extended anvil faces that can reach between gear teeth. For high-

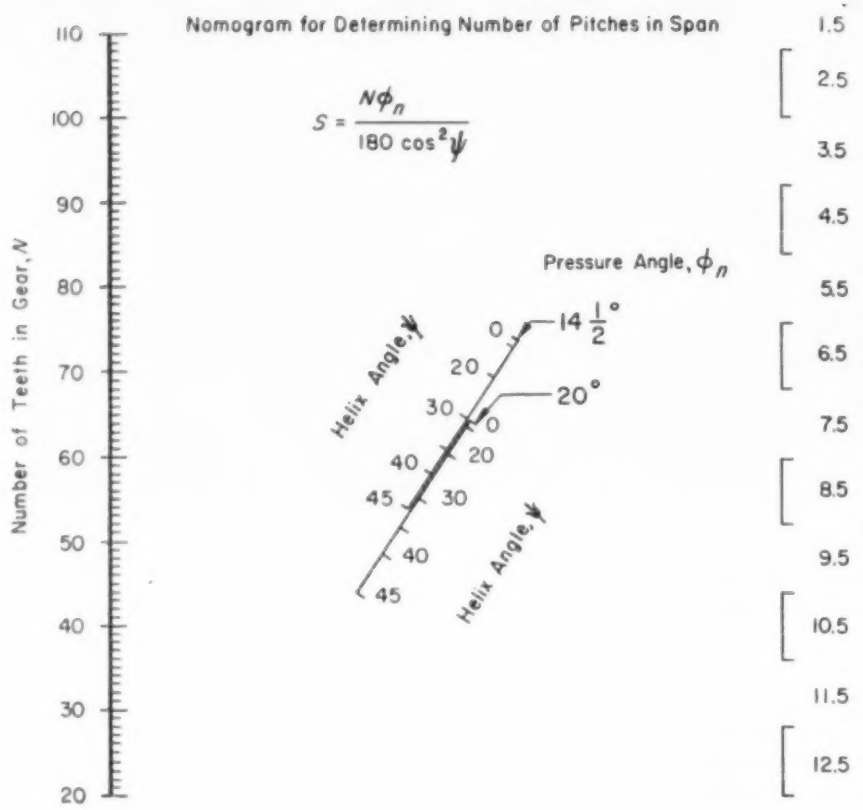


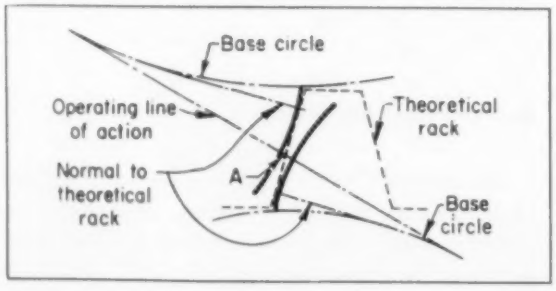
Fig. 3. With a known number of teeth, a known pressure angle and a known helix angle, this nomograph can be used to determine the number of pitches in the span for this method of gear measuring. The nomograph can also be used for spur gears, in which case the helix angle is 0.

production inspection, double-end limit snap gages can be made up. Parallel-plane caliper anvils are a requirement for measuring external helical gears. A cylindrical-anvil caliper is only acceptable for spur gears. Special instrumentation, not yet commercially available, is necessary to check internal gears, but coarse-pitch internal spur gears may be measured with the internal anvils of a common vernier caliper.

Limitation of Span Method

This method of measuring helical gears cannot be used if a high helix angle and a narrow face width combine to throw the caliper anvils off the gear teeth. This may be overcome by on-the-machine measurements when gears are stacked. The combined width of the stacked gears is usually sufficient to permit measurement. In general, narrow face widths in a helical gear require that the span of the caliper be reduced to include fewer teeth, but there is a lower limit beyond which root-fillet interference will prevent proper caliper contact. This limit is determined by trial.

Fig. 4. When base circles are shifted for nonstandard center distance operation, mating involutes will have zero backlash with a theoretical rack, but will have an actual backlash when meshed with each other. Equations 5 to 8 account for this backlash.



Helical-lead errors can affect the span measurement, but it has been observed that lead errors of sufficient magnitude to affect the measurement would be outside reasonable tolerance limits.

Total-position errors are readily noticeable because there will be a difference in measurement around the gear. They are a function of the hobber, gear-cutting machine or gear-shaper cutter, and any measurable difference around the gear is an indication that repairs to the machine are in order.

Profile errors also affect the span measurement but the same is true for any other measuring method. Because the caliper of the span method can be rocked up and down, an indication of the tooth profile accuracy is obtained. Profile error limits are usually so small they can be absorbed.

Tables of trigonometric and involute functions of the transverse pressure angle of helical gears are appended to the original paper (available from Sensory Devices Co., P. O. Box 204, New Vernon, N. J.) but are omitted from this abstract. The tables can save considerable computation time if much work of this nature is anticipated. Span dimensions, without allowance for backlash, are tabulated in the original paper for standard spur gears and reduce computation to a minimum.

NEWS

ASTE EDUCATION ACTIVITIES

featured this month

chapter news

LOOKING into the future can be risky business, especially when it comes to making definite commitments about what articles ASTE News will run in future issues of THE TOOL ENGINEER. Unpredictable elements, such as late arrival of certain vital facts, missing photographs, or the necessity of substituting a last-minute news story that is labeled 'must,' can always disrupt the best publishing schedule. However, in spite of the hazards, here is an informal announcement about what's to come in the next issue of the magazine.

OCTOBER will be travel month for ASTE News and the vacation theme will be getting a good workout. With the Society's Western Industrial Exposition coming up next March, many members will be traveling to Los Angeles to attend the year's biggest event for ASTE. Since the West holds such a variety of major attractions for convention-goers and their families, a round-up feature will be published on vacation spots, interesting things to see, and side trips to take in the Western states. Special attention will be given to an ASTE plane trip to Hawaii which is now in the planning stage.

ALTHOUGH a quantity of dramatic photographs will be used to picture the "wonders of the West," practical items—such as transportation costs, hotel rates and route information—will also be included.

IF ENJOYMENT in putting such a feature together is any criterion of its success, this October article should be one of the best published under the by-lines of your present news staff. In addition to the excitement experienced in creating this vacation section for ASTE, marked enthusiasm for new places and several good bites from the travel bug must be admitted. We hope it bites you too.

The 1955 Exposition slated for Los Angeles is providing plenty of work for these committee members.

Launch Plans for Technical Program to Coincide with Western Exposition

Conference tables are getting early use by members of the National Program Committee. Realizing the value of advanced organization, they held their first meeting June 25-27 in Los Angeles to crystallize their plans for the ASTE Western Industrial Exposition.

Responsibility for setting up the technical program rests squarely on the Committee's shoulders. When the 1955 Annual Meeting and Exposition convenes in Los Angeles, March 14-18, they want to present for ASTE's western debut.

Attending the National Program Committee meeting at the Ambassador Hotel were: Dr. Harry B. Osborn, Jr., national first vice president; Thomas C. Barber, committee chairman; Phillip R. Marsilius; Ralph Chrissie; Kenneth W. Riddle; and Frank Wilson, technical director of the Society. National Secretary Wayne Ewing and National Director Ben J. Hazewinkel also sat in.

One of the Committee's biggest tasks was selection of topics for technical sessions. The choice is based on the membership survey sent out last February. Prime interest among ASTE members proved to be heat treating, tool engineering economics, fixture design, die design and cost estimating. The program is geared to these and other top preference subjects.

Panels and paper presentations will be held simultaneously with the Exposition in Shrine Auditorium, making it possible for convention goers to view the latest production equipment and to listen to experts in the field of tool engineering—all under the same roof.

One particular session, sponsored by the National Education Committee, will cover college curricula and in-plant training of engineers.

Team work came into play when the Host Chapter Committee joined the National Program Committee for a full-day organizational meeting. The group is headed by General Chairman Carl L. Almquist of Los Angeles chapter.

Seeing to session room facilities, arrangements for the annual membership banquet, tickets, signs, and registration are only a few of their duties.

Los Angeles chapter members make up most of the committee. Attending were: Frank X. Bale, Paul R. Burt, Arthur Denis, Thomas C. Gibson, Lew W. Goodwin, Paul Lenk, J. R. Matthew, Anton Peck, A. H. Petersen, J. E. Riddle, Glen A. Singer, Paul B. Slater, George J. Tilden, John Walti, Carl Weitzel, and S. W. Winquist.

San Diego chapter was represented by Arthur Crom and E. G. Gray, Long Beach sent Carl E. Blancard, Carroll B. Edson, Lawrence Pomerantz and John Stansbury to the meeting.

R. C. Broomell, Peter Carter, Ed Cutler, Lincoln Mager and Joseph S. Wajdik were on hand from San Gabriel Valley chapter. San Fernando Valley delegates included Stanley Adamik and Rudolph Regen.

The entire group toured Shrine Auditorium facilities and those of the Ambassador Hotel, ASTE "family" headquarters during Exposition Week. All were pleased at the accomplishments of the three-day meeting and are looking forward to the most successful exposition the west has ever seen.

survey reveals
scope of chapter education activities

$9,202 in scholarships and awards provided last year --national education committee finds

By Nancy L. Morgan
News Editor

Filling the need for a measure of educational activities sponsored by ASTE chapters, a survey made by the National Education Committee paints a much-awaited picture of the different education programs of Society chapters in various parts of the United States and Canada.

Questionnaires were sent early this year to the first 108 chapters on the ASTE roster, omitting the groups chartered only recently and still young in the procedures of local chapter organization. Information was obtained directly from the chapter education chairmen.

Returned questionnaires show that a total of $9,202 was spent by the chapters to support scholarships and awards in 1953. Add to this the amount spent by the Society for its ten national scholarships of $700 each, and ASTE funds set aside to encourage outstanding students in the study of tool engineering equal more than $16,000.

Total number of scholarships provided by the chapters was 35. They ranged in value from $25 to $500. Awards, in the form of cash, copies of *Tool Engineers Handbook*, and memberships in ASTE, were presented to 92 recipients.

Impressive as these figures are, they don't tell the whole story. Education chairmen also described refresher courses, student guidance programs, contests, and courses set up for high schools, technical schools and colleges. Cleveland chapter even broke into television to dramatize ASTE and to show what tool engineering really is.

Another type of chapter education activity and one which is getting to be more popular every year is the on-campus tool engineering conference.

Sponsored by all the ASTE chapters in the state, the first one was held at the University of Illinois in 1951. Since then, conferences at other colleges and universities have been added to the Society calendar every year.

During 1954-55, for example, on-campus conferences are scheduled for: University of Iowa, Lehigh University, University of Wisconsin, Purdue University, Ohio State University, University of Houston, Michigan State College, University of Michigan, University of Nebraska, Penn State College, San Jose State College and the University of Illinois.

Chapters interested in sponsoring conferences can obtain all the necessary information on the best time to have the meeting, ways to organize the program, and what kind of sessions can be planned, from the ASTE National Education Committee, 10700 Puritan Ave., Detroit 38, Mich. A complete packet on running an on-campus conference will be mailed immediately. The Education Committee will also provide any additional help requested by the chapters.

Milwaukee chapter's $200 scholarship was awarded to John Browning by Roy Raptke, left, education chairman, and R. E. Bodendoerfer, chapter chairman.

The questionnaires also asked how chapter ucation programs were financed. A majority funds earmarked for scholarships and awards mes from affiliate memberships, chapter donations d company contributions. Other activities, such student guidance and work with the schools to rmulate courses of study, require little money to pport. These expenditures are usually absorbed the normal course of running a chapter.

While no yardstick is available to count off the hours that have been generously poured into chapter education activities and there's no way to accurately compute the complete results of work in the field of promoting tool engineering education, several observations have been made by the National Education Committee.

According to Robert E. McKee, chairman of the committee and associate professor of production engineering at the University of Michigan, benefits of chapter education activities might be counted in terms of improving educational standards of tool engineers and upgrading the profession.

"Although it is sometimes difficult to measure the direct results of education programs, certain advantages should be noted," Prof. McKee states. "Not only do the various programs benefit the participating students, but publication of news of these activities helps win increased attention for the tool engineering profession and objectives of the Society. This recognition comes from many quarters, including representatives of industry and officials of high schools, colleges and technical institutes across the country.

"Achieving what could well be called a long-range goal of ASTE, new education programs at all levels of instruction may be developed through the concentrated effort of the many chapters represented in the Society's tool engineering family."

For greater insight into how the different types of education programs are carried out, reports from five chapters have been selected for this article. No thought was given to geographical location of these chapters or the areas they represent.

The reports were chosen for completeness and amount of information available. Only limited space prevents a description of all education activities reported in the survey. *(Please turn page)*

This year's tool engineering graduates at Utah State College are pictured with Prof. Frederick Preator, sixth from left, department head. The college is the first to offer a degree course in tool engineering.

Chapter Education Activity*

	No.	Percent
Chapters contacted	108	100
Chapters replying	63	58
Chapters not replying	45	42
Chapters participating in some type of education activity	46	43
Chapters reporting programs of scholarships or awards, or both	28	26

	No.	Total Value
Scholarships awarded	35	$7,550
Awards given	92	1,652
Total		$9,202

*Here is a tabulation of questionnaires sent out by the National Education Committee. Groups chartered only recently and still young in chapter procedures were not polled. It may be assumed that those chapters which did not reply did not have any education activity to report. The questionnaire was drawn up and analyzed by Prof. Frederick Preator, head of the department of tool engineering at Utah State College and a member of the ASTE Education Committee.

Fond du Lac

student guidance program

Helping high school students to decide on engineering careers is important work for the Fond du Lac chapter. And thanks to careful planning, its student guidance program has won the respect and cooperation of high schools and industrial firms in northern Wisconsin.

For the past three years the chapter has been host to senior students from high schools in the area for a day of plant tours and conferences designed to acquaint them with the opportunities in engineering. Activities are topped off with a dinner honoring the student guests and an inspirational talk by an outstanding engineer from a well-known company.

Guided tours of manufacturing facilities at Manitowoc Engineering Co. were planned by Fond du Lac chapter as part of the 1954 student guidance activities and stimulated much interest.

This year's program was held on May 12 at Manitowoc. Nearly 90 students from 13 widely separated Wisconsin communities participated.

Also invited to the event were principals and interested instructors from the high schools represented. The chapter feels that having school officials see firsthand what ASTE student guidance is, enables the program to practically sell itself.

Serving all three years as general chairman has been H. J. Van Valkenberg, director of vocational and adult training at Fond du Lac Vocational School. His responsibility has been to enlist the aid of the various schools in lining up students to participate in the program.

Co-chairman for 1954 was Wayne Rowan of Appleton who named local committees to serve in each community represented. He was also in charge of signing up industry sponsors.

Local committees received the names of the students who wanted to participate from Mr. Van Valkenberg. Committee members then personally invited each boy to attend the program.

When May 12 arrived, the local committees provided transportation, saw to it that the members of their groups arrived at the right place at the right time, and also were taken home.

Another important phase of the work of the local committees is to provide indivdual counseling service for their groups on an "as asked for" basis. They tell the high school students what training is required for different engineering careers, what they will face when they get out of school, and what their long-range opportunities might be with an engineering background.

Students are also encouraged to contact the company sponsors for consultations. They are advised which companies to contact for specific information and directed to the proper sources within the firms.

This sincere interest of the sponsoring companies is one of the biggest factors contributing to the success of the program. These firms also make substantial financial contributions to support the costs of the program which cover student dinners as well as the rental of the hall.

The chapter has experienced little difficulty in obtaining contributions from industry, largely because many of its members are holding managerial positions.

This year's guests at student guidance day first visited the Manitowoc Engineering Co. to see engineering in action in the shipbuilding industry. Then the entire group met at Manitowoc Vocational School for 'off-the-cuff' discussions on the kinds of work and the problems engineers encounter. Led by officials of the Manitowoc Engineering Co., these sessions gave each student the answers to his own particular questions.

At 6 p.m. the chapter met with the students in the school gymnasium for dinner and a speech on "Your Future in Engineering" delivered by Martin Kozak, factory manager, Wisconsin Axle Division. Toastmaster was Leonard Kaufman, president of Kaufman Mfg. Co.

Winners of Rockford chapter's most recent drawing contest receive their prizes from Howard A. Nelson, fifth from left, chairman of the education committee. One contest is held every semester in both of the city's high schools.

Publicity wise, the student guidance program receives a 'good press.' Releases are sent out to all of the newspapers in the cities represented, with invitations for reporters and photographers to attend the dinner meeting as guests of the chapter. The publicity chairman also arranges for photographs to be taken of each high school group to send to the papers which can't cover the event in person. Photographs are sent immediately after the event, complete with captions identifying each person pictured.

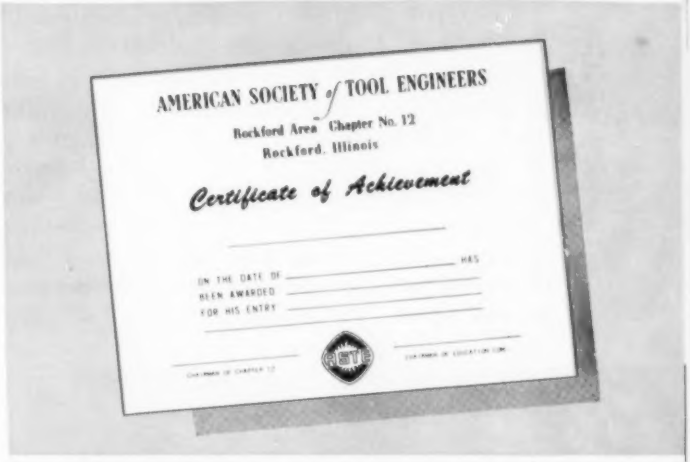
The chapter is currently compiling the results of a survey taken to determine what has happened to the boys counseled in the student guidance program in previous years. By means of questionnaires, it wants to find out how many followed engineering careers and the influence ASTE had on their decisions.

Rockford

contest for high school students

Rockford chapter concentrates its education work in the city's two high schools by sponsoring contests in mechanical drawing. The competition is run off primarily by the chapter, although several meetings are held with high school instructors to coordinate the program.

Open to all students in good academic standing, one contest is held each semester of the school year.



In addition to cash awards, certificates of achievement are presented to winners of Rockford contests.

Winners are selected by the chapter and the several awards, ranging in value from $10 to $25, are presented at the chapter's Executives Night. An additional $15 is awarded to the student submitting the best entry of all.

Subject of the most recent competition was drawing of a universal joint. Contestants were instructed to choose one of the following phases: detail and/or assembly drawing; means by which angularity can be increased; and drawing of jig for drilling holes.

Those entering the contest were given opportunity to observe manufacture and assembly of universal joints at the Mechanics Universal Joint Co. in Rockford at the beginning of the contest. Sample joints were also made available for examination.

In addition to the presentation of subject matter, neatness, accuracy, conciseness, clarity and originality of thought formed the basis for the method of judging.

Considerable publicity has been given the award program. Most recently, one of the local television stations took pictures of the presentation of awards this past spring for an evening news show, and the newspaper gave the event good coverage in a prominent position. *(Please turn page)*

Hartford

scholarship program

Awarding scholarships to outstanding students in tool engineering is a favorite education activity of ASTE chapters and one chosen by Hartford members as a type of program that fits their needs.

Every year the chapter awards four scholarships totaling $400 to young men studying at Hillyer College and the State Technical Institute in Connecticut. One junior and one senior at Hillyer receive $150 awards, and two first-year students at the Institute are given $50 scholarships. In addition, the chapter also awards a two-year junior membership in ASTE to the outstanding graduate in tool technology at the Institute.

Winners are selected by the department heads in the two schools. The awards are made on the basis of information submitted to the chapter education committee on standard application forms.

Questions asked include items on major professional interests, courses taken in the field of tool and production engineering, industrial and business experience, percent of college expenses earned, extra-curricular activities and hobbies, academic standing, and the personal background of the applicant.

Two faculty recommendations, one of which must be from the head of the department, are also required. Studies of the applicants must include those that give preparation for future work in tooling and production in industry.

The scholarship fund is supported by the chapter's affiliate memberships. As the fund grows, plans may be made to include additional awards at other schools offering appropriate courses.

Philadelphia

sponsors course

Tool Engineering courses offered by colleges and technical institutes have a far-reaching effect on the profession. Philadelphia is one of many ASTE chapters which has given its help in sponsoring classes in tool engineering subjects.

Now entering its fifteenth year, the Philadelphia course is offered at Spring Garden Institute, which is approved by the Engineering Council for Professional Development. Although originally begun with a curriculum for tool and die designing, the course was divided after the first year into two classes, "Die Designing" and "Jigs and Fixtures."

Certificates are awarded upon completion of the two-year course of study. The Philadelphia chapter also awards cash prizes each year to the students placing first and second in each class. The chapter chairman presents the awards at the graduation ceremonies of the Institute.

Classes are held two evening a week for four terms. Each term runs 16 weeks. Instructors are chosen by members of the chapter's education committee and are all members of the Society.

Philadelphia was the first ASTE chapter to give a scholarship to a woman when it presented a $500 award last autumn to Miss Joan Facey, a student at Drexel Institute. Other scholarship winners pictured with her are: William Crews, Jr., left, and Robert McGarrigle. Standing are: Campbell Pittsinger, past chapter chairman; Arthur R. Diamond, past chairman of the National Education Committee; and Clarence Hamilton of the education foundation.

Prompted by requests from industry, the course was established through the combined efforts of the Philadelphia chapter and the Spring Garden Institute. Chairman of the committee which formulated the curriculum was Edward R. Glenn, and one of the members was Howard Gross, then dean of the Institute and a long-time member of ASTE. Other committee members represented industrial firms in the area as well as the Philadelphia chapter.

Another phase of the chapter's education activi- provides for awarding of six scholarships aling $1,875 every year. Recipients are outstand- students at the University of Pennsylvania, rexel Institute and Villanova University.

Worcester

conference for vocational instructors

One of the most unusual education activities reported by ASTE chapters is the conference for vocational instructors sponsored for the first time this year by the Worcester chapter. The conference is arranged annually by the Massachusetts Department of Education to provide an opportunity for professional improvement by teachers in the various fields of vocational education.

Early this year the acting director of the department's division of vocational education, John F. Shea, asked Franklin M. Angevine, Worcester education chairman, to take charge of this year's sessions.

Mr. Angevine had attended a previous program put on by ASM and at that time suggested that his chapter would welcome an invitation to sponsor a similar conference.

A five-day series of lectures was planned, opening on June 28 and running through Friday, July 2. All sessions lasted until noon except the plant tour of the Norton Co., which was an all-day affair. About 60 instructors participated.

Subjects covered that week included: "Physics of Motal Cutting" by Dr. Robert Hahn of Heald Machine Co.; "Single Point Cutting Tools" by Joseph Jacobs of Morgan Construction Co.; "Plastic and Die Cast Molds" by Archille Giorge, a consultant who was formerly with Worcester Moulded Plastic Co.; and "Ultrasonic Machining of Hard Materials" by George Brown of Sheffield Corp.

The plant visit took the instructors through Norton's new machine division. A special session was held at the company on "Surface Finish Measurement," with a demonstration by Heinz Goehring, experimental engineer.

Besides the vocational conference, the chapter also sponsors a $300 scholarship award and was instrumental in establishing a course leading to an associate degree in tool engineering at Worcester Junior College.

Worcester education chairman, Ralph Baker, right, congratulates Frederick Lowe and Henry Krawczyk, students at Worcester Junior College, on winning ASTE scholarships for their work in tool design.

Long Beach scholarship winners received their awards from Kenneth M. Nelson, second from right, education chairman, and Carrol B. Edson, chapter chairman, at ceremonies held at a recent meeting

Three Chicago Schools to Help Sponsor Illinois On-Campus Conference

This year's Illinois On-Campus Conference, scheduled for October 8 and 9 in Chicago, could well be re-named the 'On-Campuses' conference if tool engineers in the state really wanted to be technical about it. Three schools—University of Illinois, Illinois Institute of Technology, and Northwestern University—are joining forces with the nine ASTE chapters in the area to help sponsor the event.

This is the fourth such conference to be held in the state by ASTE, but the first to take place in Chicago and the first being supported by the city's three major technical schools.

Headquarters for the meeting will be at the Navy Pier branch of the University of Illinois, but sessions will also be held at Illinois Tech and at Northwestern. Block reservations have been made for out-of-town guests at the Sheraton Hotel.

Theme for the conference is "Cost Reduction to Meet Competition." The program will touch on two major subjects. Sessions on machine tools have been planned by Rockford chapter, and meetings on the subject of tools have been organized by the Chicago chapter.

Opening the conference on Friday night will be a keynote session on "Management's Opportunities for Cost Reduction." Official greetings to the tool engineers will be extended by C. C. Caveny, executive dean of the Chicago Undergraduate Division of the University of Illinois.

ASTE's second vice president, Howard C. McMillen, plant manager for the Philco Corp., will discuss "The Tool Engineer's Function in Efficient Management." He will be followed by ASTE assistant secretary-treasurer and president of Scully-Jones and Co., H. Dale Long, who will cover "Tools for Cost Reduction."

The concluding talk, delivered for the participating schools, will be given by Dr. Halden Leedy, director of the Armour Research Institute. His topic will be "Research for Cost Reduction."

On Saturday morning, tours of the three campuses are planned, with technical sessions to begin at 10 a.m.

At Northwestern, members will hear Dr. Herhyle Spotts, professor of mechanical engineering at the university, and S. A. Brandenburg, vice president of Monarch Machine Tool Co. They will speak on "Fundamental Concepts of Design Applied to Machine Tools" and "Functional Design Requirements of Controls for Machine Tools."

Those attending the Illinois Institute of Technology session will learn about proper selection of tool materials. Speakers will be S. E. Rusinoff,

One conference session will be held at the metallurgical engineering building, above, on the campus of Illinois Institute of Technology.

associate professor of manufacturing processes at the school, and L. V. Klaybor, mill metallurgist, Allegheny-Ludlum Steel Corp.

Discussions at Navy Pier will be offered by two professors in mechanical engineering at the University of Illinois, K. J. Trigger and J. S. Kozacka.

Slated for the ladies and children are two of Chicago's outstanding attractions. The feminine program will offer luncheon and the world-famous puppet opera at the Kungsholm, while the children will visit the Museum of Science and Industry, in conjunction with a picnic lunch and supper.

They will talk on "Theory of Machining" and "Machining with Carbides."

A 12:30 luncheon at Navy Pier will provide a sociable break in the technical program. A message from the Society will be delivered by Dr. H. B. Osborn, Jr., ASTE vice president and technical director of Tocco Div., Ohio Crankshaft Co.

Two panel discussions are scheduled for the afternoon. Participating in the machine tool section will be C. Dale Greffe, associate professor of mechanical engineering at the University of Illinois; D. A. Hutchinson, chief hydraulics engineer, Sundstrand Machine Tool Co.; and B. S. Bennett, chief machine tool application engineer, General Electric Corp.

They will cover "Problems Encountered in Bearing Design;" "Hydraulics as Applied to Machine Tools;" and "Electronics for Machine Tools." Panel moderator will be E. Y. Seborg, chief engineer, Barnes Drill Co.

The tool section will be devoted to jigs, fixtures and gages. Moderator will be Harry Conn, chief engineer of Scully-Jones & Co.

Speakers are: L. E. Doyle, chairman of the ASTE National Professional Engineering Committee and associate professor of mechanical engineering at the University of Illinois; Clair Bryant, Foote Brothers Gear & Machine Corp.; and H. D. Hiatt, Allison Div., General Motors Corp.

A dinner at the Sheraton Hotel will close the conference. Addressing the ASTE members and their wives will be Herbert I. Tigges, a past president of the Society and president of the National Machine Tool Builders Association.

Serving on the planning committee for the conference are: T. C. Barber, chairman of the National Program Committee; O. D. Lascoe; member of the National Education Committee; J. H. Beck, chairman of the Chicago chapter; Harry Conn; L. E. Doyle; Roger Keough; J. S. Kozacka; R. Lindenmeyer; A. N. Oman; S. E. Rusinoff; and L. H. Seabright.

PEORIA MEETING—ASTE members at the June session of the Peoria chapter, held at the Pabst Auditorium, heard a talk by E. J. Vanderploeg, chief engineer, The Yoder Co., Cleveland. He covered the topic "Possibilities and Limitations of Cold Roll Forming." From the left are pictured: J. Mason, V. Schellschmidt, Mr. Vanderploeg, Vince Hodel and R. Yochum.—*Harold D. Baker.*

Expanded Production Courses Announced by New York University

Planned in cooperation with the Greater New York chapter of ASTE, an expanded production management curriculum will be offered by New York University during the fall 1954 semester. According to an announcement by Dean Paul A. McGhee of NYU's Division of General Education, the courses include for the first time a class in "Factory Planning and Layout."

The new course will be taught by Norman Naidish, chief engineer of Trylon Mills, Inc., and a member of the Greater New York's education committee.

Included in the topics to be covered by Mr. Naidish are the latest practice and techniques in factory planning and layout, methods of determining plant capacities, the means of balancing machine operations, and the factors to consider in designing work stations. He also will discuss modern materials, equipment, methods of materials handling, employee facilities, plant service facilities, layout of office spaces, laboratory assignments, and problems in departmental shop and office layout.

The class will meet from 6:15 to 8 p.m. on Thursdays, September 30 to January 20.

Henry E. Picarelli, production management consultant and chairman of the Greater New York education committee, will teach classes in elementary and advanced tool design.

The elementary course will cover the basic principles of tool design and their application to problems involving the use of jigs, fixtures, and gages, on both short- and long-run production jobs. Class sessions will be held from 6:15 to 8 p.m. on Wednesdays, September 29 to January 19.

The other tool design course taught by Mr. Picarelli will be of special interest to persons actively engaged in pressure working of metals. Various guest lecturers will address the class during the semester. Topics to be discussed include the design of dies—piercing and blanking, compound, progressive, trimming and shaving, bending and forming, drawing, and investment casting. Mr. Naidish will assist with the lectures. Classes are to meet from 8:10 to 9:55 on Thursdays, September 30 to January 20. Other courses and their instructors are:

Methods and motion study—Dr. John W. Enell, assistant professor of industrial engineering, New York University, 7 to 9:45 p.m., Wednesdays, September 29 to January 19;

Quality control—Dr. Enell, 8:10 to 9:55 p.m., Mondays, October 4 to January 17;

Manufacturing processes and equipment—Armen Bogossian, instructor in mechanical engineering, NYU, 6:15 to 8 p.m., Mondays, October 4 to January 17;

Inspection and production gaging methods—Fred H. Posser, director, New York Ordnance District Gage Laboratory, 7 to 9:45 p.m., Tuesdays, September 28 to January 18;

Small-plant management—Harold Engstrom, general manufacturing manager, Sonotone Corp., 6:15 to 8 p.m., Mondays, October 4 to January 17; and

Improved methods in materials handling—Raymond I. Reul, chief industrial engineer, Westvaco Chemical Division of the Food Machinery and Chemicals Corp., 8 to 9:55 p.m., Mondays, October 4 to November 22.

Registration for the production management courses will be conducted from September 13 to October 1 at the offices of the New York University Division of General Education, 1 Washington Square North, New York 3, N. Y.

EVANSVILLE PICNIC — Rutherburg Field was the scene for ASTE's annual outing held on July 12. Shown here are Past Chairman C. H. Thuman and Paul Vierling, who received his past chairman's pin at the event.—*Guenther F. Wulf*

Cincinnati Awards Two ASTE Handbooks

Two outstanding students at Ohio Mechanical Institute were presented copies of the *Tool Engineers Handbook* as awards from the Cincinnati ASTE chapter. Recipients were Edward Foegle and C. R. Moehring. The presentations were made by Dr. Max Kronenberg, National Delegate Richard Niebusch, and Education Chairman Ernest Wenderfer at the school's most recent graduation ceremonies.

—*Frank Houston*

New Orleans Members Hear Tulane Professor

Registration of professional engineers received special attention at a recent meeting of the New Orleans chapter held at Frank's Steak House. The guest speaker was Dr. Frank MacDonald, professor of civil engineering at Tulane University. At the close of the meeting booklets containing the laws and requirements for becoming a licensed engineer were distributed to all who attended. —*Joseph Natal*

Long Beach Awards Four Scholarships

A highlight of the July 14 meeting of Long Beach chapter at Lafayette Hotel was the presentation of scholarships to four students from Long Beach City College's business and technical divisions. Recipients showed outstanding abilities and adaptabilities to tool design and development.

On the same program, H. V. Harding addressed the group on "Electrical Discharge Machining and Grinding." He is technical assistant to the president, Elox Corp., Clawson, Mich.

On June 9 the chapter toured National Supply Co., in Torrance, Calif. Some 80 members were escorted through the plant which on a sight of 38 acres consists of 32 principal buildings and a total floor space of 659,000 square feet. They witnessed products from the melting furnaces to the finished item.

—Ted D. Fickes and C. W. Ward

ASTE Conference Set for San Jose State College

An on-campus conference will be held by two of ASTE'S California chapters at San Jose State College on September 10 and 11. Sponsored by Santa Clara Valley and Golden State chapters, the two-day meeting will offer several technical sessions on the subject of carbides. Topics to be covered include: engineering carbide tools for best results; the why and how for maximum carbide efficiency; and the latest application techniques. All Society members and interested guests in the area are invited to attend.

KANSAS CITY PICNIC—125 ASTE members and their families enjoyed the Kansas City's chapter annual picnic held on July 25. A major event was the ball game between the Centerliners and the Cross-Hatchers. When the game was called at dinner time, the Centerliners, with Mrs. Alvin Allen pitching, were ahead by 20-15.

Mid-Hudson Announces Education Program

After studying its recent survey to determine interest in proposed courses, Mid-Hudson chapter has announced the courses to be conducted during 1954-55 as part of the adult education program at Arlington High School.

The curriculum was planned through the joint efforts of the chapter's professional engineering committee, headed by C. J. Noll, Jr.; and education committee, headed by C. Morgan Newbury. Serving with them were J. Tesmer, L. Tenny, S. Cook, H. Keller, and H. DePew.

Beginning in September, the following classes will be held at the school: Basic Engineering I, Basic Engineering III, Shop Mathematics, Advanced Mathematics, Work Simplification, Cost Engineering, and Punch & Dies.

In January 1955, classes will be offered in: Basic Engineering II and IV, Advanced Mathematics, Method-Time-Measurements, and Hydraulics.

A guidance council, consisting of members of the education and professional engineering committees, has been set up to interview each enroller to insure registration in the proper classes. *—Davis Gale*

LEHIGH VALLEY LADIES NIGHT—Officers pose with their wives at the annual party. From left: Program Chairman George W. Savitz and Mrs. Savitz, First Vice Chairman Ralph Mueller and Mrs. Mueller; Chairman Werner Miller and Mrs. Miller, Past Chairman John Folwell and Mrs. Folwell, Secretary Vincent Scalese and Mrs. Scalese, and Treasurer Bruce Schaller and Mrs. Schaller.

Outstanding Member

Invents Directional Siren

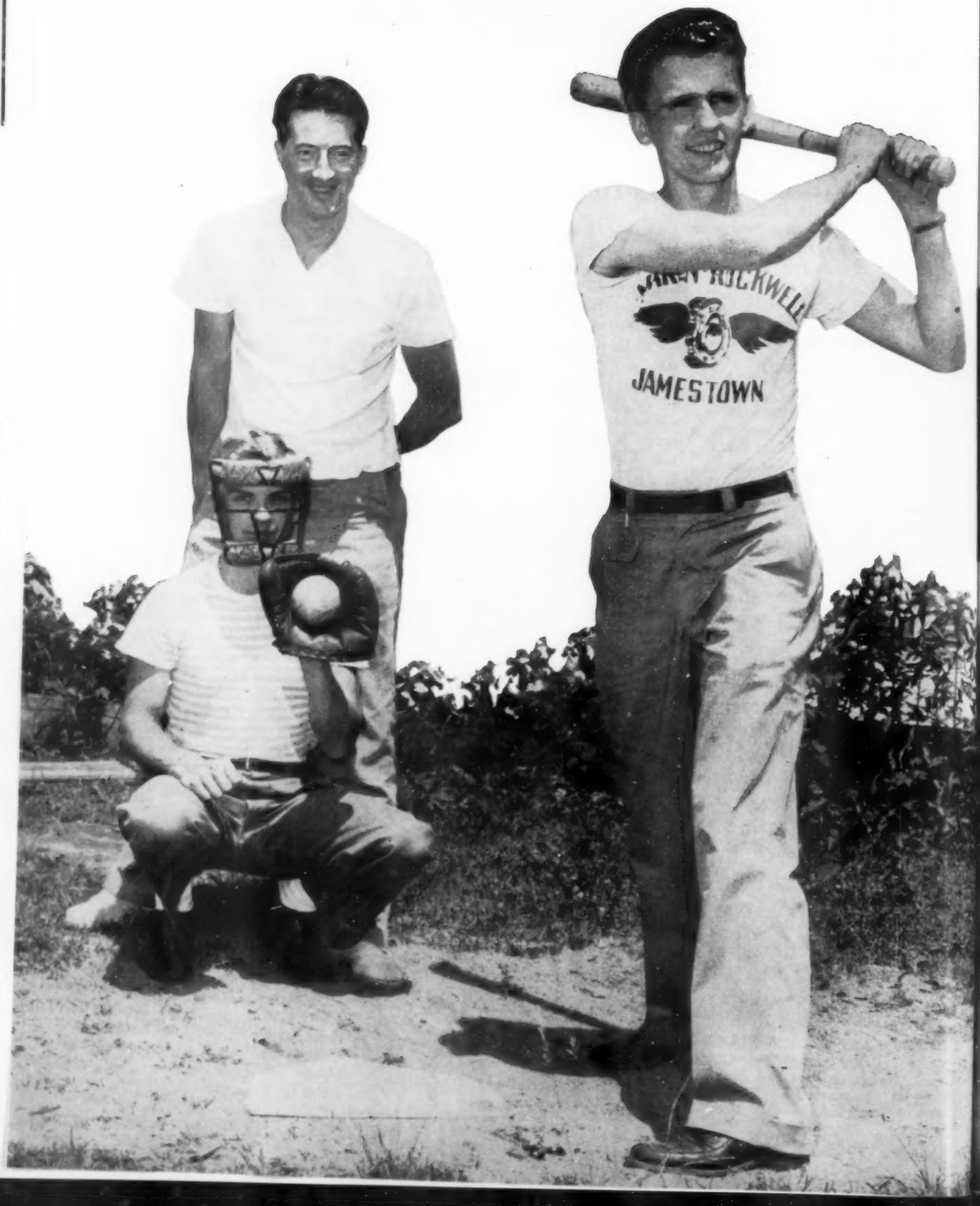
A feature story published recently by the *Joliet Herald News* tells about a new siren invented by a senior member of Louis Joliet chapter, Andrew Griparis. Owner and manager of his own manufacturing plant, Mr. Griparis plans to go into production soon with his directional siren which throws sound forward, instead of sideways as present emergency sirens do.

The present type of siren is confusing to many persons, especially to motorists, Mr. Griparis explained, because it is difficult to determine what direction the sound is coming from. With my model, there won't be any doubt about where the sound is.

As a result of an unusual sales situation, Mr. Griparis already has an order for sirens from the police department at Westchester, Illinois. He set out one day for Wisconsin to test the new siren and was picked up for speeding by a Westchester officer. Taken to the police magistrate, he began explaining his reason for going to Wisconsin and described the siren.

No mercy was shown as far as the fine was concerned, but when he returned the next day to enter his plea of 'guilty' he was also greeted with the results of his low-pressure 'sell'—an order for 25 sirens.

chapter outings



At the annual golf tournament between Littly Rhody and Boston chapters, these contestants display the trophy that goes to the team winning three years in succession. Standing, from left: Paul Watelet, John Morosini, Frank Cary, Del Krahnke and Bill Pender. Kneeling: Carl George, Joe Anthony and Bert Guindon.

This foursome ready to tee off at the Louis Joliet golf party includes: Roy Coady, Lionell Rohman, Roy Eken, and Ward Chittenden. The event was held June 19 at the Woodbridge Golf Club in Lisle, Ill.—Lionell Rohman

Opposite Page

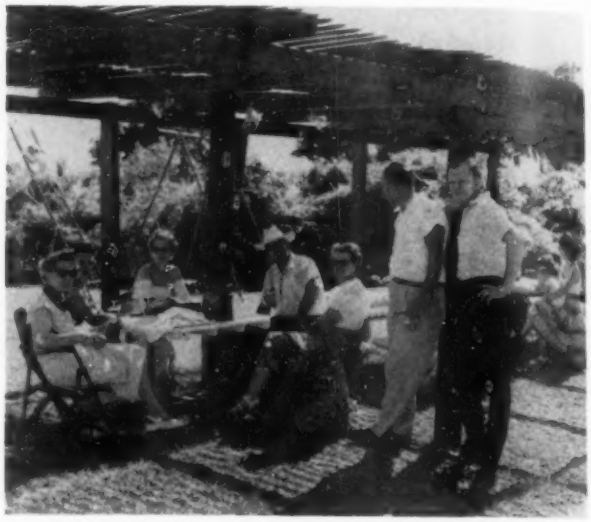
A major attraction at the Chautauqua-Warren picnic was a series of softball games. This one finds Bob Putnam at bat, Ed Freeman catching and Don Johnston calling the strikes.

A crowd of 300 Rockford golfers turned out for the chapter's "Golf Plae Dae" held at Forest Hills Country Club. These prize-winners, from left, are: William Bloom, low gross score; and Bruce Miller, low net score. The awards were presented by Joel Jannenga, right, second vice chairman and head of the day's program.—Les Teachout

chapter outings

A steady downpour greeted Portland, Ore., members at their golf outing on June 19. In spite of the heavy rain 25 contestants competed in the tourney. In the picture, Chairman Fred D. Mondin presents the trophy for low gross score to Melvin Nielsen, past chairman of the chapter.—W. L. Brenneke

Pictured here are a few of the 240 Houston ASTE members and wives who attended the chapter's annual barbeque at the Bayshore home of W. H. Lloyd on Clear Lake. The day's events included swimming, fishing, speed boating and horseshoe pitching.
—Virgil Ferguson



While St. Louis thermometers soared to 110 degrees, nearly 400 ASTE'ers ignored the heat and participated in activities arranged for the chapter's annual picnic.

These members, attired in ASTE t-shirts, seem to be bothered only by the sun in their eyes.
—Willis J. Potthoff

Rochester Continues Executive Sessions

Meetings of Rochester's executive committee have continued through the summer months in order to plan and organize the intensive program planned for the coming year. Good attendance has marked all of the 'extra' sessions.

This behind-the-scenes activity represents many man-hours of work which have gone into the chapter's future technical meetings and activities.

—Paul Bruno

Holton Fox Addresses Springfield Chapter

Forty members of the Springfield, Mass., chapter met at Springfield Turn Verein on June 14. "Nomenclature and Care of Ball Bearings" was the subject under discussion by Holton Fox. Mr. Fox, sales engineer for S. K. F. Industries in Philadelphia, used two sound films to illustrate his talk.

Entertainment on the lighter side was brought to the group by Tom Rutherford and his barber shop quartette who sang a series of ballads. Walter Kusek was in charge of the evening's program as June technical chairman.

A combination executive board meeting and steak roast was held June 30 at the home of Robert A. Smeltz, the entertainment chairman. Seventeen members were present to receive assignments for planning a November roast.

—George H. Foy, Jr.

ST. LOUIS PAST CHAIRMEN—A familiar pose is struck by these men who have served as top officers in the St. Louis chapter. The event was the annual ladies night when engraved souvenir gavels were presented to all past chairmen. From left: E. A. Doogan; C. L. Miller, R. F. Mueller; W. G. Ehrhardt, member of the National Board of Directors; J. J. Demuth, past president of ASTE; E. H. Ruder, chairman of the National Public Relations Committee; W. G. Callies; E. Stempfle; L. W. Greenblatt; E. P. Huchzermeier; and W. J. Potthoff, member of the National Book Committee.

Inter-Mountain Conference Draws Representatives from Western Chapters

Now an annual event on calendars of western ASTE chapters, the 1954 Inter-Mountain Conference was held in May as Los Alamos. About 25 members of the Los Angeles, Denver, Phoenix, Tucson, and Albuquerque chapters attended. Salt Lake City, which is usually well represented, was unable to send delegates because of heavy commitments in educational programs.

Chairman of the conference was Herman Von Steeg, head of the Los Alamos chapter which was host for the conference. After welcoming the delegates, he turned the sessions over to Wayne Ewing, national secretary of the society, who spoke on ASTE's national viewpoint.

Other subjects covered included: membership and finance; programs; education; professional engineering; and the 1955 conference. Participants included: Clinton Helton of the National Membership Committee, Ralph Chrissie of the National Program Committee, and Robert Moeller, Joseph Bourne, Bernard Billings, Gordon Anderson and Robert Kee.

Also taking part were: Douglas Williams, Willard Krieger, Cicil Conner, F. J. Geoffrey, Stanton Jones, George Buckel, Frederick Deiber, Steve Crombie, Ernest Ritchie, and Frank Coleman.

Other members were: Lloyd Wilderson, Jerome Durrie, Les Ditterbeck, Preston Ward, Clyde Elliott and Norval Allen.

After the various sessions and discussions, a dinner was held at the Los Alamos Civic Club. Next year's meeting will be held at Albuquerque.

—Basil Boss

Special Emblems for Past Directors

Resulting from action taken by the National Honor Awards Committee, all past directors of ASTE will be receiving special emblems as tokens of appreciation for their services on the Board of Directors. Appropriate presentations of the emblems are planned for meetings of chapters in which the past directors are affiliated.

Designed for lapel pins or tie clasps, the emblems will include the ASTE insignia and the words 'Past Director' appearing above and below it. They will be made of ten-carat gold with a blue enamel outline.

Suggestions for the awards came from Victor H. Ericson, a former national officer from Worcester, Mass. He submitted the idea to Roger F. Waindle, 1953-54 ASTE president, who in turn presented the suggestion to the Honor Awards Committee for consideration.

Unanimous approval by the committee resulted in submitting an emblem design to the Board of Directors. Final approval was given at the board's annual meeting in Philadelphia last spring.

A total of 223 members have completed terms as directors since the Society was organized in 1932. The list includes 23 past presidents, 13 life members, one honorary member and approximately 150 senior members in good standing.

Appointment Announced

Frederick H. Fippinger has been appointed New England sales representative of the Cushman Chuck Co. of Hartford, Conn., according to an announcement by the company. He is a member of the Hartford ASTE chapter.

positions wanted

TOOL MAKER—Have 13 years of diversified experience handling all phases of precision tool and gage making and inspection field. Now in the position of tool and gage supervisor for 4 years of well-known mid-eastern manufacturing company in Canada. Will relocate. Write to Box 394, News Department, The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

SALES ENGINEER — Experienced in carbides and all types of cutting and production tools. Have also shop experience. Wishes to represent company in eastern Pennsylvania, southern New Jersey, Delaware and Maryland. Know this area well. Write to Box 393, News Department, The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

positions available

ENGINEER—opportunity for a competent, ingenious, product designer of proven ability, to locate in mild, healthful Oregon with a nationally known, growing, electric component and electro-mechanical products manufacturer. Permanent. Enclose resume in response. Iron Fireman Co., Electronics Division, 2838 S. E. 9th Ave., Portland, Oregon.

IMPACT EXTRUSION ENGINEER—Wanted tool designer with operating experience on impact extrusion of aluminum. Must have practical experience and a thorough knowledge of the complete process. Excellent opportunity for advancement with a large aluminum concern for a well-qualified man. In reply, state your qualifications giving details of your experience in the impact extrusion process. Write to Box 555, The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

METHODS AND TOOL ENGINEERS—For details on a good job opportunity, see advertisement with box number 441 on page 282 of this issue.

SALES MANAGER—unusual opportunity with one of the largest importers of machine tools and accessories. This position offers excellent salary with rewarding percentage on all sales for sales manager with the following background: record of volume sales in the machine tool field; long standing personal acquaintance with large industrial users of metalworking machinery and dealers; proven ability to establish aggressive dealerships throughout the country . . . to organize and direct a sales staff. Submit complete resume in confidence to Box TE 698, 221 West 41 St., New York City.

KANSAS CITY GREETS LARGEST CROWD—A demonstration of optical tooling drew more than 200 members and guests to the June 2 meeting held at the American Legion building. In the foreground from left are: A. J. Sutton of Ford Motor Company's Aircraft Division, Gene Brunson of Brunson Instrument Co., A. N. Brunson who is president of Brunson Instrument Co., and Robert W. Wacasen of the same firm.—*Richard W. Corliss*

SCHOLARSHIP WINNER—James R. McBeth, right, receives Lima's chapter's $250 award from Education Chairman Burton C. Schwertfager. An outstanding student at Ohio State, Mr. McBeth also received one of ASTE's $700 national scholarships this year.

Lima Outing Features Golf and Horseshoes

Some forty members of Lima chapter attended the second annual outing which was held during June at the Lost Creek Country Club. Golf and horseshoes were the day's major activities.

Golf prizes went to W. E. Manor for the longest drive which was 275 yards, and second in this division was Gene Siferd. Other prizes for golf went to William Epley, Jim Day, Dick Shaw, Bob Sodders, Jack Robertson, Louis Hentze, Ed Gaffney and Andy Souz.

Horseshoe winners were: Ralph Mercer, singles; Louis and LeRoy Heyne, doubles; and Dick Shaw and Jess James were victorious in the tournament.

—*Donald Cox*

H. V. Harding Speaks at Los Angeles Meeting

"Electrical Discharge Machining" was the subject of a talk given by H. V. Harding at the Los Angeles meeting held July 8 at Scully's Restaurant. Mr. Harding, technical assistant to the president, Elox Corp., Clawson, Mich., revealed a newer method of machining hitherto unmachinable metals.

A motion picture of the hydrogen bomb explosion completed the evening program. Attendance figures reached the 200 mark for this meeting. One free meeting dinner is awarded to a member each month. Winners are chosen from the advance reservation cards. It has stimulated interest and attendance.

—*John A. Boettgenbach*

High-Speed Photography Covered at San Fernando

Hody's Restaurant, North Hollywood, Calif., was the scene of the San Fernando chapter's July 7 meeting. Donold H. Peterson, member of the firm of Peterson and Pease in Glendale, Calif., was the guest technical speaker. Mr. Peterson revealed the use of high-speed photography as an engineering tool. He is a member of the Society of Motion Picture and Television Engineers and the Society of Photographic Engineers.

Also on the program was "Operation Ivy," official film of the hydrogen explosion in color.

—A. J. Soares

ASTE Research Director to Address Institute

News of ASTE research activities will be brought to members of the Metal Treating Institute at their annual meeting in Chicago by Col. Leslie S. Fletcher, ASTE research director. Scheduled to speak on October 29, Col. Fletcher will address the group on "The Place of the National Organization in the Research Field." He will also touch on the possibility of joint sponsorship of research projects of interest to these two national organizations.

North Texas Calendar Includes Dinner-Dance

Annual dinner-dance time rolled around for the North Texas chapter again on June 19. Held at Amon Carter International Airport, the event included dinner, and a full evening of dancing under the stars on the open terrace. Arrangements for the program were under the supervision of Ralph E. Verson, chairman of the program committee.

—R. E. McMahan

GOLDEN GATE LADIES NIGHT—Rickey's Red Chimney was the setting for Golden Gate's final event of the season, its ladies night program. On June 19 nearly 65 couples gathered at the San Francisco restaurant for dinner and an evening of dancing to Gordon Hecke's orchestra. Entertainment Chairman Ted Lindquist was in charge of the party. Pictured from left are: Mrs. Henry Maiken, Mr. and Mrs. Norman C. Bayley, Mr. and Mrs. Norman Rupp, Mr. Maiken, Mrs. Philip R. Freeman and David A. Gustafson.—*Philip R. Freeman*

Contest Spurs Tulsa Membership

The Tulsa chapter has just completed a highly successful membership drive contest. Winner of the contest was C. E. Gahm of Douglas Aircraft, who brought 17 new members into the chapter. He was awarded a *Tool Engineers Handbook* and a lapel pin for his efforts. All members who introduced three members or more received lapel pins. The membership contest netted the chapter 37 new members for an increase of 17 per cent.—*A. I. Zumwalt*

Contest Winner C. E. Gahm

Chautauqua-Warren Holds Annual Picnic

Approximately 90 members of the Chautauqua-Warren chapter met at Spencer Barn for their annual picnic on June 19. Afternoon activities included luncheon, golf and horseshoe tournaments, and softball games topped off by an evening smorgasbord spread.

Winners of the golf tournament were Dick Freeman and Bob Swanson. In the horseshoe contest, Gordon Carlson nosed out Chairman Herbert Cave and took first place honors. During the softball games outstanding plays were executed by Howard Knobloch, Bob Wilson and Al Rogerson.

Co-chairmen of the picnic Norman Wetter and Harry Swartzfager were assisted by a committee of nine including Gordon Carlson, Floyd West, Donald Johnston, Robert Putnam, Wes Broadhead, Dick Misener, Robert Wilson, Kermit White and Leslie Beau Jean.

—Leslie H. Beau Jean

WORCESTER APPRENTICE GRADUATION—This is the 1954 graduating class of apprentices at Whitin Machine Works, an affiliate member of Worcester ASTE chapter. The class is the first to complete the new five-year apprenticeship for major trades and three years for textile machinery erectors.

—John C. Lalor

coming ASTE meetings

ASTE Board of Directors—Semi-annual meeting, Oct. 25 and 26, National Headquarters, Detroit.

On-Campus Conferences

San Jose State College—Sept. 10 and 11, San Jose, Calif. Sponsored by Santa Clara Valley and Golden Gate chapters.

Chicago—Oct. 8 and 9. Sponsored by U of I, Northwestern University, Illinois Institute of Technology and Illinois chapters including Calumet Area.

University of Wisconsin—Oct. 20-22, Madison, Wis. Sponsored by the Madison chapter.

Lehigh University—Nov. 13, Bethlehem, Pa. Sponsored by Pennsylvania chapters.

State University of Iowa—Nov. 13, Iowa City, Iowa. Sponsored by the Cedar Rapids chapter.

University of Michigan—Nov. 20, Ann Arbor, Mich. Sponsored by Michigan chapters.

Chapter Meetings

Detroit—Carbide Section, Sept. 9, 7 p.m., Modern Corp., Oak Park, plant tour. Regular meeting, Sept. 16, 8 p.m., Rackham Building, session on atomic energy. Dinner at 6:30. Education Section, Sept. 23, 8 p.m., Rackham Building, "Sheet Metal Dies and Stampings" by Joseph I. Karash, production manager, Reliance Electric & Engrg Co., Cleveland.

Evansville—Sept. 13, 6:30 p.m. "Modern Methods of Punching" by John C. Kosky of Wales-Strippit, Buffalo, N. Y.

Indianapolis—Sept. 2, "The Model Trimmer, Its Use and Application" by John Gall, sales manager, Model Trimmer, Inc., Columbus, Ind.

Lehigh Valley—Sept. 17, 6:30 p.m., Allentown, Pa. "Automation and its Applications to Machine Tools."

Little Rhody—Sept. 2, 6:00 p.m., Johnson's Hummocks, Providence, R. I. Dinner followed by tour of Mason Can Co., East Providence. Introduction of tour by George Bachman, personnel manager.

Long Island—Sept. 13, 8:30 p.m., Garden City Hotel, "Silicones" by George A. Congdon, Dow Corning Corp., New York City.

Los Alamos—Sept. 15, 7:30 p.m., Little Theater. "Lathes" by a representative of Jones and Lamson Machine Co., Springfield, Vt.

Louisville—Sept. 14, 6:30 p.m., L. & N. YMCA. "Ultrasonic Machining of Hard Metals" by J. T. Welch, manager of Cavitron Div., Sheffield Corp., Dayton. Color slides.

San Fernando Valley—Sept. 1, 7 p.m., Hody's Restaurant, North Hollywood, Calif. "Photoelasticity Analysis" by Dr. M. L. Williams, assistant professor of aeronautics, California Institute of Technology, Pasadena, Calif. Color slides.

Santa Clara Valley—Sept. 21, 7:30 p.m., Marian's Restaurant. "Fiberglass Reinforced Plastics" by John H. Sabo, Owens Corning Fiberglass Corp., Santa Clara, Calif.

Twin States—Sept. 18, Crown Point Country Club in Springfield, Vt. Annual outing.

Detroit Chapter Holds Symposium

Detroit members enjoyed a symposium-type discussion on various phases of shell molding, including chemical, design and tooling aspects. The meeting was held June 10 at the Engineering Society of Detroit.

Featured speakers on the program were E. Ensign of Metco Products Co., Ypsilanti, Mich.; and Ray Sutter of Sutter Products Company. The moderator of the discussion was Harold Sieggren of the General Motors Central Foundry Division.

Mr. Ensign discussed process and Mr. Sutter covered tooling. Mr. Sieggren illustrated the current uses of the shell molding processes.

—Walter R. Schober

R. O. Deaderick Holds Tool Show in Atlanta

The R. O. Deaderick Co., Inc., of Knoxville and Atlanta, sponsored a three-day machine tool show in Atlanta, Georgia, last spring. Richard O. Deaderick, president of the company, who planned the show, is a charter member of the Knoxville-Oakridge chapter of ASTE.

Held in the exhibition hall of the Atlanta Biltmore Hotel, the show featured an array of machines by 14 different makers. A representative group of lathes, milling machines, grinders, drilling and balancing machines were on display. *—E. H. Johnson*

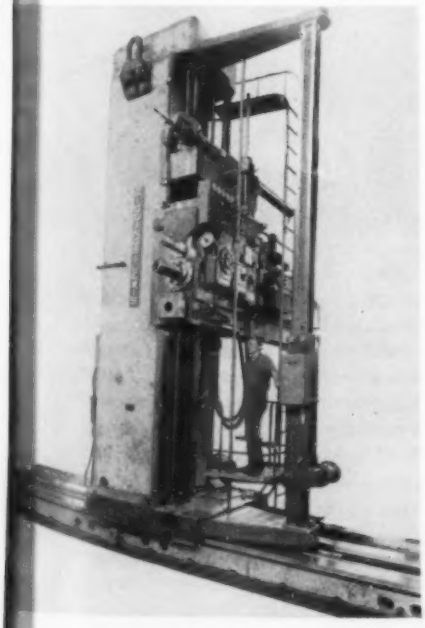
CANTON TOURS LOCAL PLANT—Ray Wise, center, vice president of Cleveland Tapping Co., explains the machining of a complicated casting to a group of Canton members at one of their recent plant tours.

news in

METAL WORKING

DESIGN ELEVATOR FOR WORK ECONOMY

Operators of the Giddings and Lewis' 50 series Fuar Tracer machine can work quickly and safely over the face of the large unit by means of the unusual platform arrangement developed by G & L engineers. The platforms work like an elevator to permit the operator to change his position to any height on the column without disturbing the spindle or stylus setting. He can return quickly and safely to floor level for tools or other equipment without climbing up and down the column ladder.



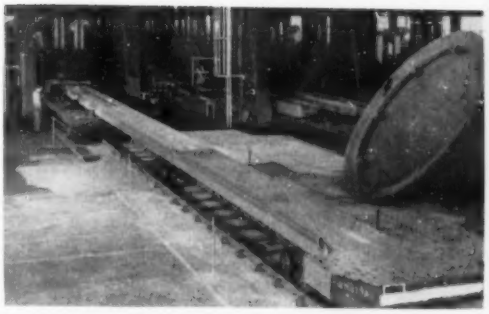
'STRETCH' MACHINES TO TRIPLE CAPACITIES

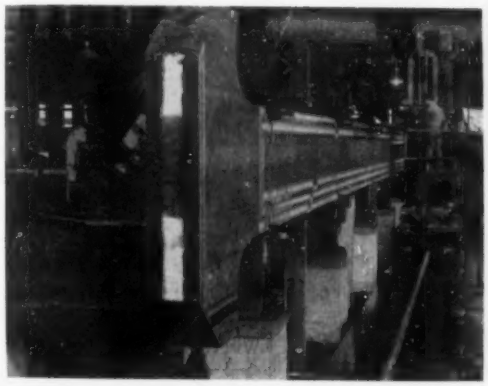
Engineering skill and ingenuity were combined to accomplish an unusual job at Bethlehem Steel Co. where machining of giant forging press column sections for a 35,000-ton press designed by Loewy-Hydropress, Inc. for the Air Force necessitated travel of several machine tools at the plant to be nearly tripled. Tool engineers "stretched" capacity of existing machines by improvising specially built additions for the units.

In the machine shop, a roughing cut of 1-in. on all main surfaces was removed on a planer, (top, right) whose normal stroke was 36 ft. To triple the worktable travel in order to machine the full length of the workpiece, buggies, running on accurately-leveled trackwork extending about 100 ft in both directions from the crossrail, supported ends of the long column. Work utilized two toolheads operating simultaneously.

A further interesting improvisation (center, right) involved placing a horizontal boring and milling machine on a double-end boring machine carriage. This afforded the miller a longitudinal movement of 105 ft—more than adequate to machine the full length of the 101-ft column section at one stroke.

Final machine shop operation called for multiple milling (bottom, right) of a complete laminated column which meant a full set of three members milled at one time to assure assembly accuracy. Both ends of the column were worked at once with horizontal boring mills on a special setup.





FASTER BRAZING TECHNIQUE PROVES ECONOMICAL

Increased production rates for brazing work at reduced operating costs are achieved through a rotor-brazing technique developed by Selas Corp. of America. The process offers several work advantages as well. Brazing alloy can be pre-placed insteal of hand fed. This fact, plus the automatic control of the heating cycle, assures reproducibility of results and therefore releases the operator for other related operations during the heating period. Timing control of the process provides both physical and chemical control over the combustion reactions.

Setup for the brazing technique is seen in the photograph. Sixty-four copper bars are being brazed to the end ring of a rotor for an industrial electric motor Selas Superheat burners.

In this specially designed equipment, work rotates within an adjustable ring of 14 burners. Each of these burners becomes, in effect, a small jet furnace in which premixed air and gas is burned. Hot products of combustion are emitted at high velocities through a slot in the burner. This gives a localized heat at high speeds and all copper bars are brazed simultaneously.

The process itself requires less than five minutes time while floor-to-floor time—which includes loading, heating, cooling, unloading—takes but 15 minutes compared with 1½ hours.

Cost for the brazing new technique netted an enormous saving for the company—comparative figures set the price for natural gas consumed in this rotor brazing method at 3½ cents as against $2 for the torch brazing method which uses oxygen fuel.

LACK OF ENGINEERS MAY HASTEN AUTO-FACTORY

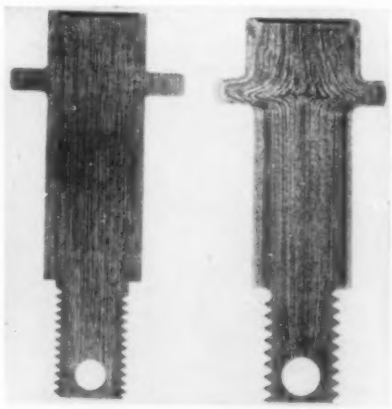
Single bright prospect in the problem of the shortage of engineers in the field today seems to have been voiced recently by David Robinfien, supervisor of the Computer center at Armour Research Foundation. His opinion is that this lack of engineering personnel will be yet a further prod toward bringing the automatic factory into reality. He points to the fact that the computing machines already have alleviated need for highly trained men from the type of routine activities that in the past "has hounded many projects into failure."

At present steps toward automation have embraced only operations which merely continue the process of mechanization—a change from hand tools to machine tools.

Eventually, he said, automation should include a set of techniques for achieving the automatic plant, and minimize human participation in all of its phases.

DEMONSTRATE ADVANTAGES OF FORMING TECHNIQUE

Graphic demonstration of the extent to which modern cold-forming techniques permit severe displacement of metal without fracturing or interrupting grain structure is shown here with the comparison of a cold-formed part (on the right) with a machined part (at the left). The cold-formed part was made



from steel wire, and acid-etched to show grain lines. In contrast to the machined part, particularly in the threaded section, where sharp cutting of the grain structure has introduced weakness, the cold-formed example has retained maximum strength in both tension and shear. At the same time, compression of the outer fibers of the cold-formed part, indicate increased surface hardness, characteristic of pieces made by Cold-Flow, a process developed by Camcar Screw & Mfg. Corp.

SPECIAL MELTING PROCESS FOR BETTER TITANIUM

Metal quality of titanium has been improved dramatically by the results brought about through the increasingly large titanium remelting furnaces plus substitution of a special vacuum melting procedure for inert gas atmospheres in these furnaces. In addition, the progress in processing the metal shows promise of significant cost reductions, according to the Titanium Metals Corp. of America.

Removal of hydrogen from the titanium metal down to as low as 0.005 percent or 50 parts in a million is permitted with perfection of the new melting process. Formerly, the usual procedure involved flooding the furnace with slightly positive pressures of argon or argon-helium mixtures. This improvement is important in the light of recent proof of detrimental effect of hydrogen to titanium's physical properties.

Other important advantages of the vacuum melting procedure are the more stable electrical arcs, ability to accommodate greater power inputs, introduction of smooth ingots that require little or no conditioning prior to continuous mill conversion into sheet and strip for military airframes or direct fabrication into bars and billets for jet engines.

Titanium Metals has now developed the world's largest automatic double-melting furnace of proprietary design that completely remelts primary meltings into 24-in. 4,000-lb titanium ingots with improved metal homogeneity.

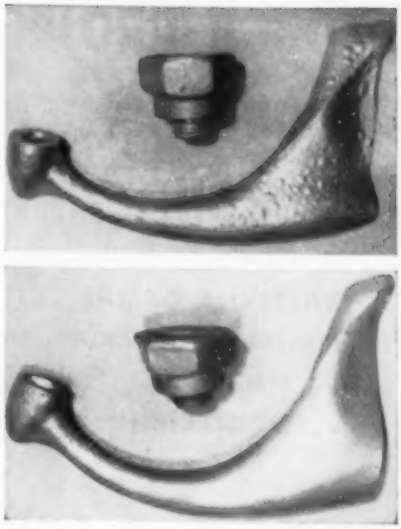
The vacuum techniques have proved out on this furnace with such success that further improved units currently are under construction, and double-melting furnaces for 8,000-lb ingots are being considered.

DEVELOP VACUUM METHOD FOR CASTING ZINC

Reduced internal porosity, increased skin hardness and thickness, and an increased tensile strength have been accomplished for zinc alloy castings through a vacuum die casting method recently developed by Nelmor Mfg. Corp. Naturally, the field for die castings is expected to be considerably enlarged as a result of the process that provides these improved characteristics.

The vacuum casting process uses a standard die casting machine, operating under special semiautomatic electric controls, and can accommodate any die casting die that can be normally mounted on the machine. Some die adaptation is required in order to hold a vacuum; however, the die may readily be returned to a former use with no impairment to its original condition.

Two production parts, each cast by the standard and vacuum casting methods, offer good opportunity for comparing results. One of the parts is a rear-vision mirror frame casting, selected because it has consistently been a troublesome casting problem—an estimated



Photographs, right, permit comparison of end results after casting. At top is seen an arm and nut, cast by standard methods, after heating from room temperature to 750 F for 45 minutes. Below is exhibited an arm and nut, made by vacuum casting, after heating to the same temperature in the same time period.

25-percent scrap occurs in its casting, buffing and plating. The second part is a backup light switch housing which previously could not be held consistently to the minimum torque test requirements of 32 ft/lb.

When these two parts were run alternately standard and vacuum, the vacuum die cast nut showed an increase in torque tests to be between 55 and 60 ft/lb, and the mirror arm showed an increase in depth of harder surface skin. This allowed heavier and deeper buffing without exposing porosity. The parts were then subjected to commercial laboratory testing to evaluate results.

Visual and surface inspection tests revealed the surface quality of both casting methods to be high.

Actual differences, however, showed up in X-ray examination that revealed high density for the vacuum casting compared to relative porosity for the standard casting; weight comparisons also indicated a higher density of the casting made under vacuum. Photos made of the castings heated slowly to just below melting point revealed expansion and escape of trapped gases to be of considerably reduced volume under vacuum. Tensile strength for comparable sections proved to be greater under vacuum; and the skin harder and depth of skin greater under vacuum.

Specifically, Rockwell tests, using the H scale, of 24 standard and 24 vacuum castings showed the average hardness for the standard group to be 4.2 as compared to 5.9 for the vacuum cast group.

Tensile strength of 6 samples was tested, giving an average of 82,383 psi for the vacuum cast samples as compared to 78,000 psi for those standard cast.

IMPROVED AUTOMATION OF GEAR PRODUCTION

An important stride toward automatic operation of entire gear production lines has been achieved by Michigan Tool Co. as a result of further alterations made on its previously developed three-way gear selector.

Primarily the unit, which is applicable to most gear cutting or finishing machines, was created to grade and separate gears automatically into correct, oversize and undersize gears. Now, with this further refinement, it has become a machine controller because it can automatically readjust the machine at any time an oversize or undersize gear comes from the unit. In fact the device is sensitive enough that it will correct the machine for the deviations caused by temperature variations dur-

ing the day, or for greater dimensional errors brought about by tool wear. If a slightly undersized gear comes off the machine, the device adjusts the machine in one direction; if a slightly oversized gear emerges, it adjusts the machine in the other direction.

Should a specific percentage of off-size gears come from the unit in a given time, however (as would happen when tool wear becomes pronounced), the device automatically shuts off the machine, signaling the line operation that the machine needs attention.

In addition to quality control, the machine offers a considerable advantage in the form of speed. Operation is practically instantaneous, and as indicated there is no time lost in resetting of machines to produce correctly sized gears. Scrap loss should be reduced since immediate automatic inspection takes place for each part followed by correction of the fault causation by means of the readjustment feature.

INNOVATION IN STEEL SAWING

Speed and economy are achieved with a structural steel cutting machine designed by Luria Engineering Co. as part of the program to improve operating techniques at its fabricating plants. The machine, shown in action in the photograph, performs with four times the speed attained by conventional saw machines generally used for cutting steel.

The tool utilizes three acetylene-oxygen torches to cut heavy structural steel on all sides simultaneously to any bevel within $\frac{1}{32}$ inch. Comparing times for cuts made on wide steel beams shows two minutes for the acetylene-oxygen machine as against eight minutes for mechanical saws to do the job. Resultant saving in labor cost is substantial, and this labor saving of course carries over into speedup in production and eventual faster delivery.

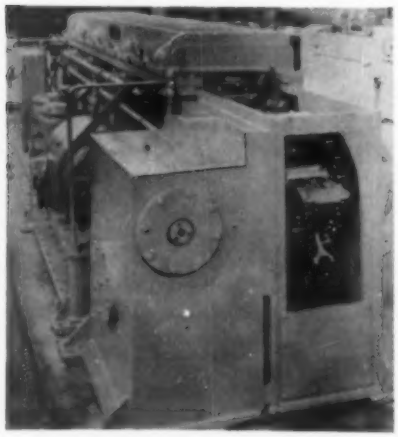
TOOLS of today

Continuous Broaching At High Speeds

The Lapointe Machine Tool Co., Hudson, Mass., has designed and built a new horizontal type continuous broaching machine for broaching parts at high production rates.

According to the manufacturer, a production rate of 900 parts per hour can be obtained in broaching the sides, face, and half-round of an automotive connecting rod, operating the machine at minimum speed. When broaching at top speed, this same machine is capable of doubling that production rate. On this steel forging part, the amount of stock removed is approximately ⅛ inch per surface.

Rear view photo shows the cover removed from the machine in order to see the drive chain and the delivery position to release a part.



This unit has been designed with a series of individual, self-operating, self-locating and self-clamping fixtures so arranged that the operater merely has to insert the parts into the work nests. Should anything occur to interfere with its normal operation, the machine will stop automatically. Powered by a 30-hp motor, the machine is built with a 120-in. stroke. A drive-chain carries the workpieces by the broaches that are stationary. Drive sprockets are so designed that they can be renewed or replaced quickly without removing the drive chains.

A broach-carrying bridge, hinged on pivots on top of the machine, swings open easily for changing broaches. It will accommodate the main broach assemblies of any type within the capacity of the machine. The machine can be supplied with an electric hoist assembly on it, to remove broaches with maximum ease. **T-9-1161**

Titanium Alloy Sheet

A weldable high-strength titanium-base alloy sheet has been announced by Rem-Cru Titanium, Inc., Midland, Pa. The sheet alloy, Rem-Cru A-110AT, contains 5-percent aluminum and 2½-percent tin, balance titanium.

It is readily welded with the same techniques used for commercially pure titanium and the ductility of fusion welded joints has been reported to be excellent. In addition, this grade has a minimum tensile strength at room temperature of 115,000 psi and maintains this strength at elevated temperatures better than any other commercially available titanium-base alloy.

It can be supplied in sheet form in thicknesses down to 0.025 inch, as well as the previously available plates, bars and forging billets. **T-9-1162**

USE READER SERVICE CARD ON PAGE 137 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Self-Contained Automatic Drill Unit

A self-contained automatic drill unit which operates on a low volume of air has been announced by The Dumore Co., Inc., Racine, Wis., to be placed on the market in September. The unit, series 24, is simple to set up, requiring only two outside connections, conventional shop air and electric power, or can run on a small portable air compressor.

Mounted by the nose bracket, costs and time of setup for the unit are cut considerably. Relays, switches and valves are built in. The Dumore units can be mounted in any combination, radial, vertical, opposed or angular, in standard brackets. If it is necessary to move the unit, the bracket can remain in place, thereby retaining the setup for future production.

Its ten spindle speeds range from 440 to 7400 rpm. The unit which is driven by a timing belt is available in either ½ or ⅓-hp motor with varying voltages. Chuck capacity ranges from No. 60 drill to ⅜ inch.

Stroke may be synchronized with indexing fixtures, sequence operations, etc., through a built in synchronizer

auxiliary circuit which is part of the standard equipment.

In addition to its prime function as a drill unit with conventional chuck attachments, the unit can be converted to such operations as tapping, reaming, deburring, centering, counterboring, spot facing, countersinking, hollow milling, etc.

An exclusive attachment, an electronic repeat cycle timer, is available for deep hole drilling, to clear chips and to permit coolant to reach the drill point in deep holes.

An especially designed optional hydraulic control accessory, which controls the rate of feed, is available for drilling hard materials at special angles or on curved surfaces, etc.

The units can be mounted on standard drill press columns. A trip control for one head in any multiple setup can be individually cycled for control operations.

The unit operates on resistance drilling or control feed. Both of these combine to lessen drill breakage and errors.

T-9-1171

Lifting Tool Uses Vacuum

As long as the trigger in the pistol grip type handle of the Pres-Vac Lifter is held down, the suction cup will pull 1 psi. This is a revolutionary application of compressed air to an important production operation. It provides a constant, positive lifting power by passing compressed air through the venturi at

45 psi, creating a constant vacuum of 22 inches of mercury. The vacuum is conveyed to the rubber cup through passages in the handle. Lifting is speeded up and made easier, resulting in multiple savings and increased safety in warehouse and production line work.

Through an unusual application of compressed air, this tool can be used to lift sheet steel, glass, plywood, masonite, plaster board, complete cabinets—in fact any object that has a flat surface on which a vacuum can be maintained.

Literature and other details available from the manufacturer, F. J. Littell Machine Co. Air Div., 4555 Ravenswood Ave., Chicago 40, Ill. **T-9-1172**

Single-Pass Tap

Horspool & Romine Mfg. Co., Inc. 5850 Marshall St., Oakland 8, Calif. have introduced a tap capable of tapping most Acme threads in a single pass. Relatively fine leadscrew threads used at the starting end have the effect

of pulling the heavier Acme thread cutting portion of the tap through the hole, much as a starting screw on a wood bit. Use of a lead screw feed is not recommended. The design provides an accurate smooth thread. It is available for single or multiple-start Acme threads in diameters from ¾ to 2½ inches. **T-9-1173**

Hydraulic Tracer

With the Trace-O-Matic hydraulic tracer attachment recently introduced by Axelson Mfg. Co. Div., Pressed Steel Car Co., Inc. 6160 S. Boyle Ave., Los Angeles 58, Calif., conversion of Axelson's general purpose lathes to contouring production machines is possible.

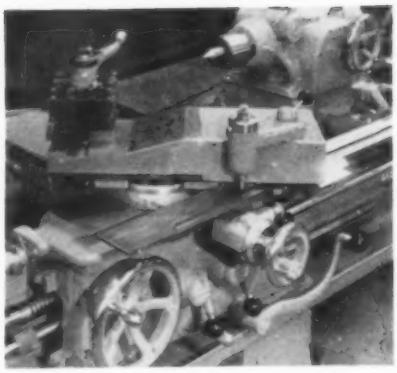
It also offers still further advantages by reducing costs and handles a variety of work economically that formerly presented production problems.

Initial installation is but a matter of a few hours and reverting to a standard lathe takes only 15 minutes, with no special skill or training required for its operation. Setup from one job to another is fast, requiring only minutes. The unit does not restrict the swing or capacity of the lathe, yet takes advantage of the speed and power of the Axelson lathe to take heavy roughing

cuts or fine precision finishing cuts. Small job lot work or quantity production work can be handled with equal speed and efficiency.

Parts are duplicated from flat, inexpensive templates which can be put on the machine and positioned for work in a few minutes. These serve for both roughing and finishing work. The stylus exerts only a few ounces of pressure on the soft template proper.

All classes of work with uninterrupted cuts are handled automatically. Close contoured tolerances can be maintained and the finished dimensions of the work will be practically the tolerances built in the templates.



Tungsten carbide tools of the single point type tool bits are preferred for use with this unit and form cutters are not required.

Additional information is contained in the Axelson Trace-O-Matic bulletin which may be obtained from the company. T-9-1181

Resin for Tools and Dies

A resilient tool and die material based on Shell Chemical Corp.'s Epon resin, has been announced by Kish Resin, Inc., Lansing, Mich., rounding out that company's line of formulations for casting hard tool surfaces, for core material and a laminating resin for glass-reinforced tooling.

The formulations offer the low shrinkage qualities of the Epon resins, dimensional stability, adhesion and chemical resistance. Both the resilient and hard materials can be used to surface steel, plastics, cast iron or the special Kish high compressive strength core material.

Shrinkage during cure is as low as 0.0001 inch per inch, permitting reproduction of complicated die contours accurately, thus avoiding machining and hand finishing. Adhesion properties of the resilient material assure permanent bonding to unlike surfaces. T-9-1182

Angle Measurement Chart

The George Scherr Optical Tools Inc., 200 Lafayette St., New York 12, N. Y., has announced development of an angular measuring chart for use on optical comparators.

This aid, known as the gage protractor chart, permits rapid and accurate measurements of all angles for the full 360 degrees with a vernier reading to 5 minutes of arc. It is adaptable to all models of Wilder micro-projectors, as

well as all types of projectors not equipped with protractor screens or rotary tables. It is fast, precise and eliminates need for making up angular drawings or the use of less precise mechanical protractors.

Of unbreakable satin finish plastic, the chart remains unaffected by moisture, temperature changes, etc.

Literature on the complete line of gage precision plastic charts is available from the company. **T-9-1191**

Hydraulic Transmission

This heavy duty variable speed hydraulic transmission, designed for operating pressures up to 3,000 psi, has been introduced by Waterbury Tool, Div. of Vickers Inc., Waterbury, Conn. It consists of a 112 gpm variable and reversible delivery axial piston pump and a constant displacement axial piston motor. Assembled as a packaged unit, all valves and controls, including an auxiliary pump, relief and replenishing valves, are built in.

The unit is capable of speed from 0 to 1150 rpm in either direction, accurate control of creeping speeds under constant load down to 1 rpm, rapid reversals, and smooth acceleration and deceleration. It will operate under overloads to 200 hp. **T-9-1192**

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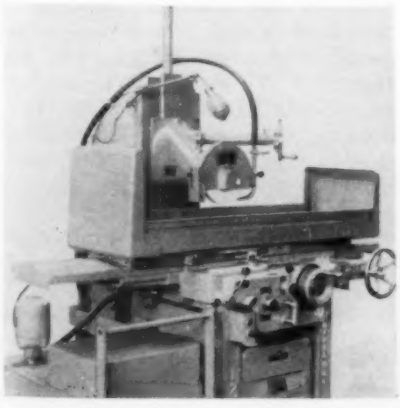
Surface Grinder without Backlash Problems

A cross feed backlash eliminator is an outstanding feature of this 1218 Hydrabrasive surface grinder introduced by Abrasive Machine Tool Co., Dunellen Rd., East Providence 14, R. I. Due to this special design, precision transverse adjustments may be made completely without backlash errors. The backlash eliminator works in combination with the saddle ball ways to insure that a movement of 0.0001 inch on the cross feed dial equals 0.0001-inch movement of the saddle, regardless of which direction the adjustment is made. The cross feed handwheel is equipped with a large diameter barrel and easy-to-read vernier, for quick, accurate adjustments with minimum danger of reading errors. Complete details are included in literature available from the manufacturer. **T-9-1193**



Sheet Metal Brake

Hand operated, the universally adjustable sheet metal brake introduced by R. E. Smith, 1122 Elizabeth Ave., Waukegan, Ill., is capable of forming virtually any shape. The compactly built unit, occupying only 30 by 40 inches of floor space, will accommodate 18 gage sheets up to 26 inch wide, or progressively narrower widths and thicker gages up to $\frac{3}{16}$-inch mild steel $1\frac{1}{4}$ inch wide. As a further advantage, 180 degree flanges up to $1\frac{1}{4}$ inch wide may

be formed in one operation without repositioning the work. Wider flanges can be formed to any angle up to 164 degrees.

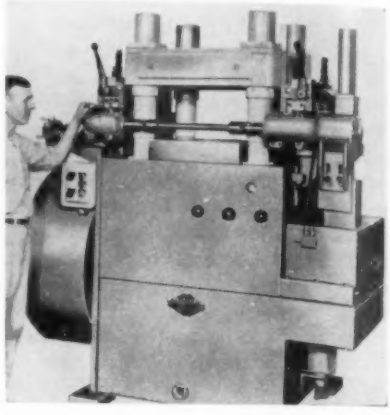
Its design assures accurate radius bending.

Pans can be formed 1¾ inch deep from 1 inch to 26½ inch wide by proper selection of upper mandrel fingers. Selective bending of portions of a sheet, such as flanging the inside of a square or rectangular hole, or the square throat of an elbow is accomplished by removing any of the lower fingers that would distort the sheet while the bend is being made.

From the operating position at the end of the brake, the operator has full visibility of each side of the machine and the work to assure maximum working efficiency and accuracy. **T-9-1201**

High-Speed Press

Alpha Press and Machine, Inc., 9281 Freeland Ave., Detroit 28, Mich., has developed a 75-ton, high-speed production press. It offers a 4-in. maximum length of stroke. Maximum speed of 1-inch stroke is 300 per minute; of a 2-inch stroke is 200 per minute. By means of an air clutch and brake combination, strokes can be inched, single or continuous. Clearance between columns, from right to left, is 19 inches; from front to back is 15 inches. Other sizes, right to left between columns, are available in multiples of 6 inches. Front to back dimensions remain constant. Lubrication is by automatic force feed to all moving parts. All controls are electrical.



Point loading of 75 tons can be handled anywhere along the center line of the machine, right to left, column to column. Unbalanced dies can be handled without distortion. Shut height adjustment at top of press permits accurate releveling of upper ram in respect to bolster plate. **T-9-1202**

Gear Driven Positioners

Units for positioning heavy weldments to obtain better welds in the downhand position have been introduced by Aronson Machine Co., Arcade, N. Y. These gear driven positioners, Models HD160 and HD240, have box-type chassis so that all motors and electricals are enclosed within the chassis for protection. The table rotation gears are totally enclosed and packed with grease at the factory providing lifetime minimum backlash. The HD160 positioner can support 16,000 lb at 12 inches center of gravity. The table tilts 135 deg in 46 seconds with full load. The HD240 positioner will support 24,000 lb at 12 inches center of gravity.

Both units have table rotation from zero to 0.64 rpm and are standard with magnetic braking. The table tilts in 46 seconds with full load. Precision limit switches and magnetic braking on the tilt movement provide smooth safe stops of heavy weldments. All drives are direct coupled; there are no belts. Six table heights are standard on both positioners from minimum of 59 inches to maximum of 95 inches. T-slot tables provide 54 x 54-inch clamping area. Positioners are easily adapted to constant speed and/or fixed base operation. The rotation torque is increased 50 percent when the table rotation is at 0.35 rpm or lower on both models.

T-9-1211

Wear Resistant Iron Alloy

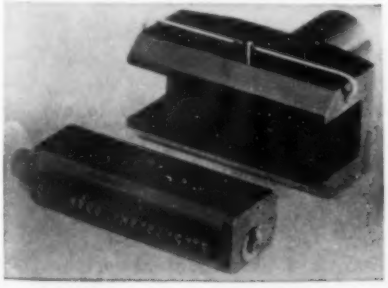
An especially hard, abrasion-resistant iron alloy, Tisco 150-Y, is announced by Taylor-Wharton Iron and Steel Co. The alloy can be heat treated to 700 Brinell, provides longer life—tests indicate life expectancy of 2 to 6 times other alloys used for the same purposes—suggest savings due to fewer replacements and reduced maintenance costs. **T-9-1212**

Type Holders for Marking

Quick-change holders for steel type used in connection with impression marking has been introduced by Heidrich-Norse Co., 631 E. Third St., Los Angeles 13, Calif.

The type holding mechanism stands up under high impact loads yet permits rapid change of type setup at any time. The holders work similarly to quick-change toolholders posts for engine lathes, and may be used in punch presses, squeezers, impact machines, air and hydraulic presses etc.

A chuck with a shank, which normally stays locked in the machine, and a removable type-holding insert, which is held in the chuck by a spring-loaded positioning plug, make up the unit. No tools are required to change inserts. Holders are available in single and double line capacities, with type recesses in 1, 1½ and 2½ inch lengths. Shank sizes are ¾ or 1 inch with other sizes available on order. **T-9-1213**



Spray Coolant System

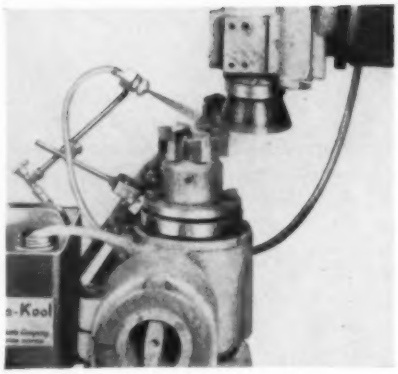
Spray-coolant may be applied quickly and economically to any type of dry grinding or polishing operation as well as certain drilling, milling, chamfering, or boring operations that do not require flood coolant by the Spra-Kool system announced by Bar Products Co., 3703 Highcrest Rd., Rockford, Ill.

This system is designed with a simple valve and spray nozzle which provides a steady, uniform jet spray of coolant to tools and work. The fine spray prevents dust and efficiently dissipates heat from

work, allowing continuous grinding without burning, heating or warping.

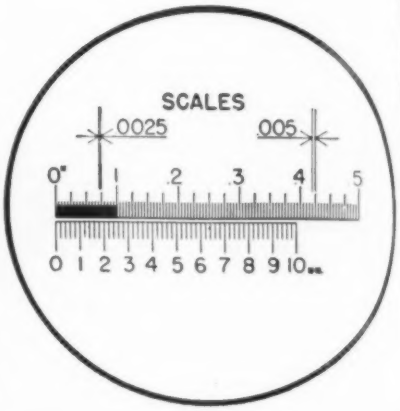
Since it eliminates dry grinding, the system provides longer wheel life, and prevents damaging work from excessive heat. A rust inhibitor mixed with the coolant also prevents tarnish and rust stains.

The simple Spra-Kool mechanism is designed for quick setups and easy use. A length of hose is attached to any air line, the nozzle is then positioned to the work, and the spray control is adjusted to provide maximum cooling results. There are no pumps, settling tanks, or complicated filters, and no splash guards or drain pipes are needed since any excess spray evaporates quickly. The amount of coolant applied is easily varied either by adjusting the air pressure or raising or lowering the siphon level of the coolant. Operation is unaffected by sudden or varied drops in air pressure. **T-9-1221**



Pocket Optical Comparator

The Pee Gee pocket comparator, a compact precision optical instrument used to measure extremely small parts or minute dimensions on large parts, is being distributed by National Tool Co., 11200 Madiosn Ave., Cleveland 2, Ohio. Measurements are accomplished through the use of a powerful magnifying lens (approximately 6 power) and tiny transparent patterns called "reticles." These reticles are actually extreme reductions of large precise "Master" layouts, The "Scales" reticle, number 103, which comes in the instrument and is illustrated, is used to measure dimensions from 0.0025 to 0.5 of an inch in steps of 0.0025 and 0 to 0.10 MM in steps of 0.2 MM.



Other reticles are available for measuring radii angles, threads, thickness, diameters and dimensions for linear measurements.

Construction includes a Lucite body, and an adjustable lens barrel and reticle retainer ring of machined aluminum with a black anodized protective finish.

Instant focusing may be done by sliding the eyepiece further in or out of its Lucite body. Fine adjustment is accomplished through a built-in screw arrangement. A stainless steel spring, near the top of the body, holds a steel ball which keeps the instrument in adjustment. **T-9-1222**

Trimming Press

A Brehm trimming press has been designed and built by the Brehm Div., The Steel Products Engineering Co., Springfield, Ohio, in order to use the Brehm trimming die more efficiently. In addition, it frees larger, heavier punch presses for their regular forming operations.

The trimming press uses only the power and time required for the par-

ticular shell that it is trimming. By merely changing cutting adapters it can be set up to trim shells of any size and shape up to 16 inches square and 6 inches deep. Thickness of the material can vary up to 0.125 inch.

The ram stroke is approximately 15 inches. The time for a complete trimming cycle is about 4 seconds.

Compact in size, the 8-ft-high press requires less than 22 square feet of floor space. **T-9-1231**

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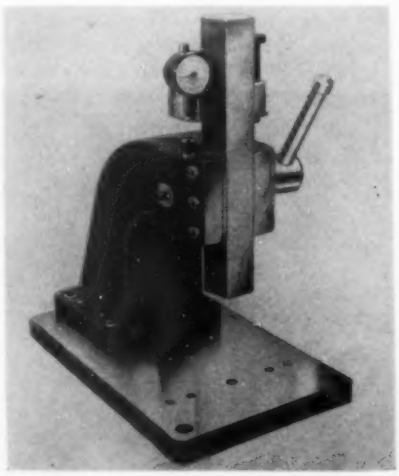
Precision Arbor Press

A Micro arbor press to permit close tolerance assemblies where press fits are required has been designed by Queens Tool Engineering and Mfg. Co., 15 Front St., Rockville Centre, L. I., N.Y. It may be used also for piercing, broaching, forming and burnishing operations that require precision line-up and controlled depth.

The ram and gear rack are of a one-piece construction. After machining, teeth are milled, ram pack hardened and then precision ground in line with the 0.500 locating hole in the end of the ram. If the unit is to be used for work requiring only comparative precision, a quick adjusting screw on one side of the stop that bears against the stop plug in the frame is brought into use. If special precision is required, a screw is backed up and a dial pressure indicator graduated in 0.001 on the opposite side of the tool is utilized.

Exact alignment of the ram with the base may be checked and held within 0.002 FIR, swung on a 5 in. radius with the base. Through the adjusting screws, the ram can be adjusted one inch before having to relocate the stop in the next tooth of the gear rack. **T-9-1232**



Unusual Rotary Table

Giddings & Lewis Machine Tool Co., Fond du Lac, Wis., offers an unusual rotary table, the Air-Lift, that is completely self-contained, with no complicated pieces to assemble. It is particularly useful when more than one face of a workpiece is to be machined. The table contains a collapsible index pin which eliminates all play or lost motion in the mechanism and compensates for any wear which might take place. The plunger can be firmly locked in the table and index block every 90 deg for positive indexing. Graduations are used for positioning between these 90-deg intervals.

The table can be quickly and easily revolved. By turning a valve at the base of the platen, air is forced into the

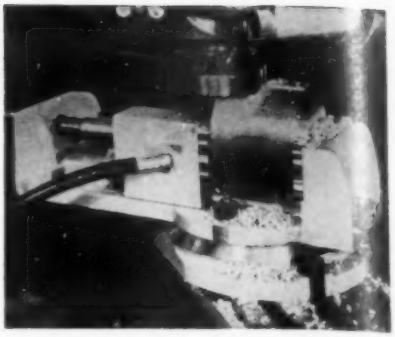
unit, raising the table approximately 0.001 inch. With the air acting as a bearing, the table "floats on air" and can be indexed to the desired position by simply turning the table by hand. Off center loads can be easily and accurately indexed.

The table can be provided with either round or square platens. **T-9-1241**

Air Hydraulic Machine Vise

Wilton Tool Mfg. Co. Inc., 925-941 Wrightwood Ave., Chicago 14, Ill., has placed on the market a power operated milling machine vise, under the trademark WiltOmatic M-M, that combines speed of air vise with the strength, compactness and locking force of hydraulic vises. It eliminates need for special production tooling when used as an automatic holding fixture with specially formed jaws, yet offers a considerable cut in loading and unloading time.

Prime contribution of the WiltOmatic M-M vise is the combined use of compressed air and hydraulic fluid. With the touch of a toe on an air valve, the operator can instantaneously place a force of 9000 lb on the jaws of the



vise. Yet, the tool is flexible, adjusts with ordinary crank handle motion to any desired opening and can be locked manually as well as under power.

Normal air line pressure of 90 lb is recommended, although the vise functions on any air pressure from 20 to 140 psi. **T-9-1242**

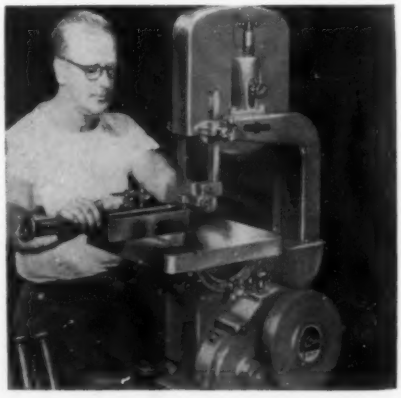
Metal-Cutting Band Saw

A two-speed, 12-inch metal-cutting band saw that makes quick, easy work of trimming and contour sawing a wide range of metals has been introduced by Atlas Press Co., 2412 N. Pitcher St., Kalamazoo, Mich. Sturdily built, accurate, efficient and easily portable, the unit will saw iron and steel, including stainless and high carbon, as well as brass and copper. It is low in cost, both initial and operating.

The Atlas cuts to the center of a 24-inch circle; has 6¼-inch capacity above 14x14-inch tilting table, and two blade speeds of 100 and 250 fpm.

Included among its features for greater efficiency are: floating motor rail for quick-speed changes, easily adjustable blade guides and ball-bearing blade support wheels, conveniently located controls, and compact design for easy portability.

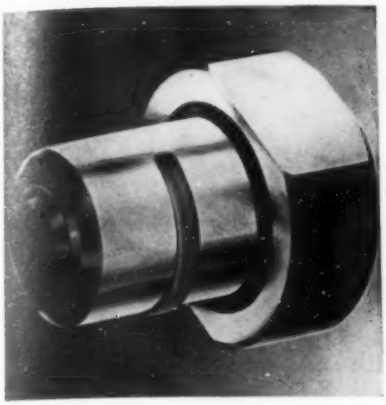
Physical specifications include: 12-inch throat capacity; 6¼-inch depth of cut; blade speeds of 100 and 250 fpm. **T-9-1243**



Fixture Key

A fixture key made by the Standard Parts Co. offers extensive time and cost saving as a result of avoiding milled keyways.

Two drilled and reamed 5/8-inch holes



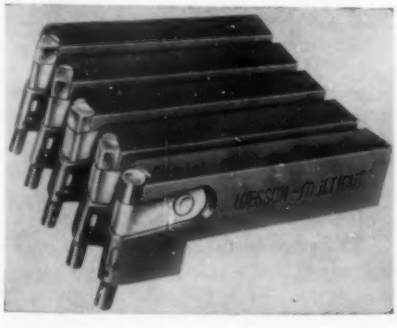
in the fixture make all keys quickly interchangeable.

These Sure Lock fixture keys can be tightened into the fixture from either the top or the bottom of the key which increases convenience and accessibility. Automatic alignment is assured by tightening the keys from the top of the fixture while in place in the T slot.

An illustrated bulletin and price list is available by writing the company, 1000 Broadway, Bedford, O. **T-9-1251**

Toolholders With Height Gage

The band type Multicut toolholder made by Wesson Co., 1220 Woodward Hghts. Blvd., Detroit (Ferndale 20), Mich., now incorporates a precision ground carbide height gage as a result of a design feature to provide more rapid insert setup. Permanently brazed to the holder adjacent to the insert slot, the flush gage eliminates need for additional rules or gages ordinarily required in resetting inserts exactly on center. Field tests indicate reduction of down time as much as 30 percent through its use.



Simplified setup permits an operator to set the insert accurately to 0.001 inch, simply by feeling the top of the insert and flush gage with his finger tip.

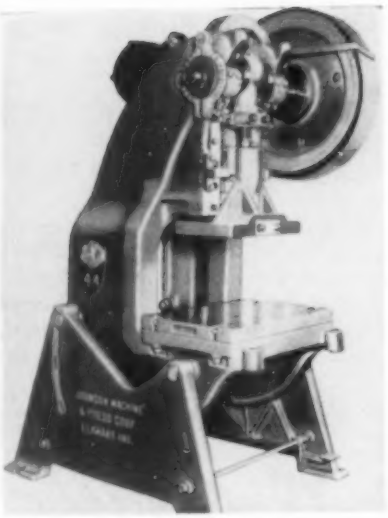
Another design feature is an elliptical slot for easier insert removal. Under severe cutting operations which generate excessive amounts of heat, the coolant and metal dust is often "baked" around the insert. Even under these conditions, the new slot will make quick and simple insert removal possible.

T-9-1252

OBI Punch Presses

Extra wide beds, extra deep throats, extra large openings through back, extra large ram faces and extra shut height characterize the three new open-back inclinable punch presses offered by Johnson Machine & Press Corp., 620 W. Indiana Ave., Elkhart, Ind.

Model 44, pictured, is the middle-sized of the three models. Adaptable to most medium-size intermediate press tasks, it provides 43 tons of pressure at bottom of the stroke. Standard



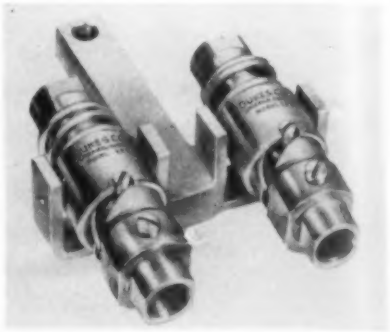
stroke is 4 in. with up to 8 in. available on special order. Bed size is 32 x 22 in. with 21-in. opening through the back. Shut height bed to slide is 12½ in. with stroke down and adjustment up, with 25 in. maximum shut height. Depth of throat is 12 in.

A smaller unit, Model 33, offers a 27-ton capacity with standard 2½-in. stroke, with similarly reduced specifications. Largest press of the three, the Model 55, provides a 56-ton capacity with a standard 4-in. stroke, and comparatively greater dimensions and specifications. **T-9-1261**

USE READER SERVICE CARD ON PAGE 137 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Coupler

Coupling with full pressure on both sides of the line is the outstanding feature of the Model 112KS Break-Away coupler designed by Dukes Co., Inc., 2108 N. Southport Ave., Chicago 14, Ill.



It offers positive break-away action, withstands hard usage, and is designed to meet requirements of equipment manufacturers.

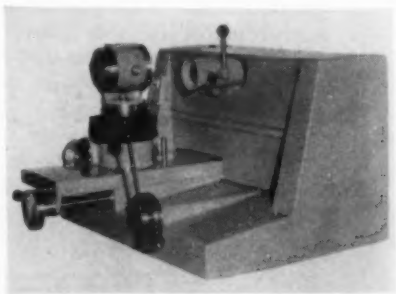
Nylon valve seats assure positive self-sealing on break-away. It can be mounted individually or in tandem.

T-9-1262

Unit for Cutter Grinding

Designed for cutter grinding only, the versatile Sterling Model RK-2 tool and cutter grinder introduced by McDonough Mfg. Co., Eau Claire, Wis., will handle practically all the tool and cutter grinding requirements in the average shop.

On this unit the work remains stationary and the grinding wheel moves.



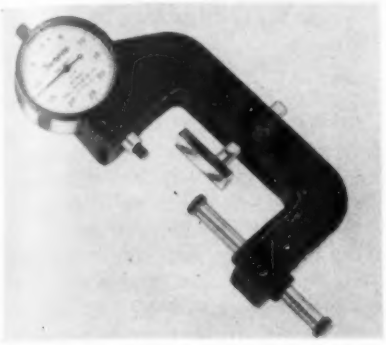
This avoids need for the usual tables and makes possible a compact machine with all controls grouped within easy reach of the operator, and makes setups easier to make.

The machine will handle cutters up to 14 inches in diameter and the grinding wheel has a travel of ten inches.

T-9-1263

Fast-Checking Snap Gage

For fast, exact comparisons of workpieces, the Geneva dial snap gage with its large flat backstop precisely positions workpieces while offering unusual speed and convenience. This precision gage can be easily adjusted without fumbling or rocking the work back and forth to get an accurate reading. The sturdy ½-inch cast iron frame is thin enough to enter close places encountered in some types of production work. Design allows full travel of the indicator and it is a balanced unit with compensation for weight of gage and hand.



The adjustable indicator dial has a positive internal lock for fine settings and may be fitted with tolerance hands or plate as required for specific operations. Its simple design of few moving parts means less repair.

There are four models of this improved Geneva dial snap gage available, varying in these ranges: 0.125 inch, 0.060 inch, 0.125 inch and 0.060 inch.

For detailed information and specifications, write to the Chicago Dial Indicator Co., Dept. L, 180 N. Wacker Drive, Chicago, Ill. **T-9-1271**

Attachment for Surface Grinder

The Magic City Machine Tool Co., Muncie, Ind. has developed an inexpensive and quickly installed attachment for the surface grinder, which provides many benefits of wet grinding without inconvenience.

An adjustable sight feed with connected tubing places approximately a drop of coolant a second into a Flying Saucer—a specially louvered disk fitted against the back of the wheel—which gathers air, compresses it and forces the moisture through the wheel, coming out at the peripherum and point of contact in a fine, quickly evaporating mist.

For heavier grinding, more liquid

may be applied at sight feed.

A second Flying Saucer disk with air foils on the front of the wheel creates a low pressure or suction through the porosity of the wheel helping further to distribute the moisture.

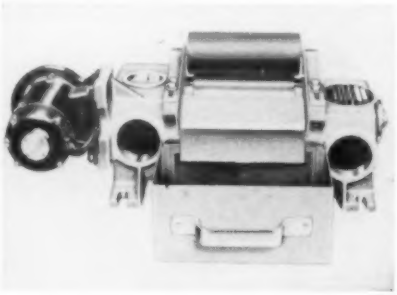
For diamond up wheel, holes as above will allow moisture to wash wheel and work.

The compression and expansion developed through the wheel, help create a refrigeration, cooling the workpiece and preventing warpage. **T-9-1281**

USE READER SERVICE CARD ON PAGE 137 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Automatic Separator for Liquid Coolants

Ferrous metallic particles are automatically filtered from coolants and cutting oils with the small, compact Houdaille Magnetic separator introduced by Honan-Crane Corp., Lebanon, Ind. Continuous operation provides a constant supply of clean coolant for



all types of machine tools. Separator can be installed on the machine tool sump.

Contaminants are removed by means of permanent ring magnets completely enclosed in a revolving cylinder. Construction assures 360 degrees of constant magnetic attraction.

Turbulent flow of coolant in a specially designed channel below the cylinder keeps metallic particles in suspension until attracted by magnetic field.

The Houdaille magnetic separator is available in 10 and 20 gpm capacities for soluble oils; 5 and 10 gpm for mineral oils. **T-9-1282**

Readers' Viewpoints

. . . tap-drill diameters for cast iron

To the Editor:

I would like to present several comments to the authors of the article "Increase Tap-Drill Diameters and Save Money" by Begeman and Chervenka, published in the June 1954 issue of THE TOOL ENGINEER.

In general, the article indicates that the 75-percent full thread normally used in industry is greater than necessary. This percentage results from widely published tables for tap-drill sizes. The article indicates that about 50 percent of thread would be ample, including allowance for margin of safety to cover such factors as runout of drill, etc.

These conclusions are so sweeping that it is well to examine them carefully to see what extent, if any, tap-drill selection tables should be modified.

It should be emphasized that this article applies only to a steel screw for a hole tapped in steel. In the machine tool industry, nearly all tapped holes are in cast iron—rarely in steel.

The depth of tapped holes in steel should be equal to the diameter of the screw. In cast iron, however, the hole depth is 1½ the screw diameter.

No mention is made of tightening and loosening the screws within the tapped holes a number of times so as to simulate wear. Also, nothing is said about mutilation of the thread, caused quite frequently by pulling the wrench too hard and overstretching the threads.

While it could not be expected of the authors to cover all possible cases in one short article, a paragraph or two of caution would have been worthwhile to stress the limitations and scope of the article.

Granger Davenport
Chief Engineer
Gould and Eberhardt, Inc.
Irvington, N. J.

To the Editor:

We appreciate Mr. Davenport's interest and comments pertaining to our article on tap-drill diameters and regret that there may have been some misunderstanding regarding its scope. As we stated, the investigation applied only to steel bolts engaging threads tapped in steel. We did not investigate steel threads engaging threads in cast iron as there has already been some

work published along this line. Also we did not have time to study threaded connections using a variety of materials.

Other conditions, such as the effect of improper tightening, wear, mutilated threads, poor quality, etc., which could not be controlled, were recognized but not introduced into the tests made.

Although we considered these and other possible variables before beginning and made efforts to minimize their effects during the tests, we decided that a reasonable allowance added to the critical percentage as a margin of safety was the most practical method of providing for them.

Prof. M. L. Begeman
C. C. Chervenka, Graduate Student
University of Texas

. . . molded nylon gears

To the Editor:

We have noted the article "Tooling for Injected Molded Nylon Gears," by Louis D. Martin, in the July issue of THE TOOL ENGINEER. In this article are mentioned three methods of making molds for nylon gears. We would like to call attention to a fourth method of making these molds, which we believe will supercede the ones mentioned in the future article.

The method we mention is the making of mold cavities by electroforming. We are now setting up a plant to manufacture cavities by electroforming based on the work done in England over the past decade. The mold cavity is electroformed around a hob made of brass, plastic or other suitable material. The electroformed material has a hardness of 45 to 50 Rockwell C. Cavity dimensions are no more than 0.0002 or 0.0003 inch different from the hob. The electroforming is continued until the cavity wall is of the desired thickness. Cavities are then finished and set in steel bolster plates as with beryllium copper or steel hobbings. Cavity life has been shown to be approximately equal to hobbed cavities.

This method of manufacturing cavities does not have the limitations of the methods mentioned. Cavities for worm gears similar to those pictured on the cover of the July Tool Engineer are just as easily made by this method as straight spur gears.

Very little polishing is required after electroforming. There is no risk of tolerance loss or tooth shape distortion during this operation.

W. J. B. Stokes, II
Stokes Trenton, Inc.
Trenton, N. J.

To the Editor:

In the article "Tooling for Injection Molded Nylon Gears," I indicated the several geometric considerations which

must be given to tooling for injection molded nylon gears in order to allow for molding variables. I also pointed out that much of this subtle reasoning is all too often overlooked by mold makers because of their lack of knowledge of gear geometry. The remarks made relative to the several mold making techniques were incidental.

Space limitations did not permit a lengthy discussion of all of the possible ways that cavities can be made. I am glad to hear of another method which, as Mr. Stokes put it, ". . . will supersede the ones mentioned in the article."

Regardless of which method is used to produce a cavity, it is necessary to start off with a facsimile of the production gear properly corrected for shrinkage. In each case, to produce a usuable gear, the proper geometric correction must be made.

I know about electroforming and have had several disappointing experiences trying to make worm cavities by this process. That's why it wasn't mentioned. We tried a number of approaches, the first one involved the use of a hardened and ground steel mandrel. This mandrel was used as a core about which was plated iron over a very thin film of tin. Our experiments with this process were disappointing. The biggest difficulty was in stripping the mandrel from the mass of electroformed iron, even with the tin stripping film.

We next made the mandrels of aluminum which were dissolved out of the electroformed iron mass (after it was machined), with caustic soda. This procedure worked much better but we were never quite able to obtain cavities free of voids and minute pinholes which showed up under molding pressures.

After several heart-breaking disappointments we gave up the idea in favor of a chasing technique in nitralloy steel which we perfected and which worked well. We were able, by this process, to obtain steel cavities which were nitrided to a case depth of 0.003 to 0.005 inch that had a smooth, hard, wear resistant surface. These cavities have been in use for several years.

It is quite possible that Mr. Stokes' electroforming technique is far better than the one we used, which incidentally, for the sake of prudence had better be kept anonymous. The arts are advancing, and while it is hard to imagine that a nickel cavity having a hardness of 40 to 45 Rockwell C can compare favorably with one made of tool steel and/or tungsten carbide, as is the case with cavities produced by electrical discharge and ultrasonic machining techniques, they may be the answer to a molder's dream.

Louis D. Martin
Gear Consultant
Rochester, N. Y.

Trade Literature

For Free Booklets and Catalogs—
Convenient Request Card on Page 137

Grinding Wheels

Bulletin 6925 describes rubber-bonded centerless grinding wheels; giving examples of their applications and explains how they function to accomplish desired finish with fewer passes; also includes information of regulating or feed wheels. Raybestos-Manhattan, Inc., Manhattan Rubber Div., Passaic, N. J. **L-9-7**

Gaging

Comprehensive 12-page Bulletin 542 pictures and describes electronic gaging equipment for dimensional inspection and control applications; not only describes separate units, but explains how they work together, their applications and advantages. Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio. **L-9-2**

Surface Broaching

Illustrated brochure deals with company's duplex vertical Hydro-Broach machines outlining details of design and their advantages, and offering brief application data in case history form. Includes specifications. The Cincinnati Milling Machine Co., Cincinnati 9, Ohio. **L-9-3**

Switches

Catalog 101, "Switches for Industry" covers company's 22 "families" of switches; includes dimensionalized photos, gives complete characteristics, electrical ratings and technical data. Micro Switch, Div. of Minneapolis-Honeywell Regulator Co., Freeport, Ill. **L-9-4**

Plunger Pumps

Photos, charts and line drawings are included in bulletin W-414-B45 containing information on features, applications, ratings, dimensions and specifications of VTE, VTE-1 and VTE-2 types of vertical triplex, single action plunger pumps. Advertising and Sales Promotion Dept., Worthington Corp., Harrison, N. J. **L-9-5**

Rivet Tools

Brochure deals with Hi-Shear rivet tools, explaining how each type works. Well illustrated with drawings and includes dimension tables for each kind of tool in the group. The Hi-Shear Rivet Tool Co., 8924 Bellanca Ave., Los Angeles 45, Calif. **L-9-6**

Lubricants

Current issue of company's publication "Metal Talk" contains product information about its industrial lubricants and coolants. S. C. Johnson & Son, Inc., Racine, Wis. **L-9-7**

Cold Steel Forming

Booklet shows how certain tubular products are formed by Koldflo method; step by step illustrations explain work; includes information on process of value to design and process engineers. Koldflo Div., Mullins Mfg. Corp., Salem, Ohio. **L-9-8**

Dry-Film Coatings

Forty dispersions of colloidal graphite, molybdenum disulfide, vermiculite and zinc oxide are listed in folder, "A List of 'dag' Dispersions for Industry," outlining typical applications, densities, carriers and other important data for each. Acheson Colloids Co., Div. of Acheson Industries, Inc., Port Huron, Mich. **L-9-9**

Thin Bearings

Engineering Catalog 54, "Reali-Slim Bearings," gives descriptions, technical data and formulas useful to design engineers using these bearings which have ¼-in. cross sections and ¼-in. width up to 12-in. ID up to 1-in. cross section width up to 40-in. ID. The Kaydon Engineering Corp., Muskegon, Mich. **L-9-10**

Welding Aluminum

Latest developments in welding aluminum are described in 176-page book, "Welding Alcoa Aluminum." Comprehensive text plus photos and drawings cover all practical methods for welding aluminum, including torch, arc, resistance and pressure welding; includes discussion on selection of method, performance of welds, welding of castings, and control of quality. Request directly from Aluminum Co. of America, 733 Alcoa Bldg., Pittsburgh 19, Pa.

Regulators

Leaflet K-2076 describes and illustrates recently developed electronic regulator for speed, voltage and tension regulation for industrial electric motor drives; covers features, functions and typical applications. Reliance Electric and Engineering Co., 1076 Ivanhoe Rd., Cleveland 10, Ohio. **T-9-11**

Spindle Bearings

"X-Ray Story of Filmatic", brochure No. G-604, presents information on Filmatic bearings with complete details concerning the construction and the advantages offered by this type. Well illustrated by drawings to show points discussed. The Cincinnati Milling Machine Co., Cincinnati 9, Ohio. **T-9-12**

Press Selection

Sixteen-page booklet, "How to Choose the Right Press," covers selecting correct press, type of power, frame design and accessories for particular work. Interstate Machinery Co., 1465 W. Pershing Rd., Chicago 9, Ill. **L-9-13**

Carbide

General catalog covers complete line of company's carbide products, including blanks, inserts and tools and tool holders; also offers a technical data section with pertinent information on speeds, cutting selection of rake and relief angles, grade selections, suggested tool sizes for various depths of cuts, etc. Newcomer-Products, Inc., Latrobe, Pa. L-9-14

Degreasing

Proper degreaser operating methods treated in manual entitled "Vapor Degreasing Do's and Don'ts," covers every phase of metal cleaning including correct layout and maintenance of equipment, efficient operation, machines, safety and other points. Extensively illustrated. Manufacturers Processing Co., 1360 Hilton Rd., Detroit 20, Mich. T-9-15

Dust Control, Blast Cleaning

Condensed bulletin 1210 presents entire line of equipment and accessories for blast cleaning and dust control, all listed by equipment, by type and by purpose. Explains three blast methods, their advantages, and applications. Pangborn Corp., Hagerstown, Md. T-9-16

Squaring Shears

Complete information on company's entire line of underdrive squaring shears is presented in comprehensive illustrated bulletin 69D; describes fully the various construction features and main advantages; includes specifications for each of 48 models. Niagara Machine & Tool Works, 683 Northland Ave., Buffalo 11, N. Y. L-9-17

Industrial Trucks

Extensively illustrated brochure offers close examination of the construction and workings of company's electric fork trucks; useful as a reference for those concerned with operation and maintenance of this type equipment. Baker-Raulang Co., 1250 W. 80th St., Cleveland, Ohio. L-9-18

Plug Valve Actuators

Eight-page bulletin 3120 describes tandem type actuators for valves requiring relatively high torques, and the floating bar type actuators for use on valves requiring lower operating torques. Gives actuator selection table, typical applications, dimensions and weights, and various mountings. Ledeen Mfg. Co., 1600 So. San Pedro St., Los Angeles 15, Calif. T-9-19

good reading

FERROUS PROCESS METALLURGY *by John L. Bray. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price $6.50. 414 pp.*

Contained in this textbook are condensed descriptions of equipment used in ferrous metallurgy and line drawings. Statistical material has been kept to a minimum and includes only that for important countries or significant years. Free use is made of physical chemistry in explaining processes and predicting future developments.

MACHINERY'S HANDBOOK, 15TH EDITION. *Published by The Industrial Press, 148 Lafayette St., New York 13, N. Y. Price $9.00. 1,911 pp.*

This mechanical reference book makes available in concise, ready-to-use form, hard-to-find as well as established data needed by machine and tool designers, engineers, management, mechanics and students.

Combined in this edition are features of earlier versions and recent data obtainable.

LUBRICATION OF INDUSTRIAL AND MARINE MACHINERY *by William Gordon Forbes. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price $6.50. 351 pp.*

The purpose of this book is to provide a manual for explaining the fundamental characteristics of conventional lubricants. Some basic mechanisms, such as bearings, gears and compressors are explained in detail.

Integrations of lubrication principles with lubrication requirements of mechanisms aid in solving lubrication problems.

MATHEMATICAL TABLES *by L. J. Comrie. Published by Chemical Publishing Co., Inc., 212 Fifth Ave., New York, N. Y. Price $6.50. 387 pp.*

This book contains a collection of mathematical tables for general purpose use requiring more than four-figure accuracy.

Among the tables contained are circular functions, exponential and hyperbolic functions and logarithms of trigonometrical functions of angles.

PROFITABLE SMALL PLANT MANAGEMENT *by Malcolm H. Gotterer. Published by Conover-Mast Publications, Inc., New York, N. Y. Price $5.50. 318 pp.*

This book is intended to serve the needs of three groups in the small plant field: those seeking information necessary to formulate a cost reduction or management development program; those who want to supervise and evaluate the results of management specialists; and groups needing knowledge of scientific management theories.

Among the subjects discussed are: plant layout, production standards, wage incentives, job evaluation, merit rating and cost control.

ELEMENTS OF MECHANISM *by Venton Doughtie. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price $6.00. 494 pp.*

This book brings the reader abreast of new developments in mechanisms by using current terminology and examples.

It is designed to introduce applications of basic principles of physics and mathematics in mechanical movement and to develop thought and the powers of visualization necessary in analyzing mechanical devices regardlesss of complexity. Problems are included.

METALS AND HOW TO WELD THEM *by T. B. Jefferson and Gorham Woods. Published by The James S. Lincoln Arc Welding Foundation, Cleveland 17, Ohio. Price $2.00. 322 pp.*

Written as a combination text and reference, this book helps make possible better welds at lower cost. The properties and structure of common metals and how to weld them are clearly explained. Welding terms, illustrations and tables are included.

TIMING BELT DRIVE ENGINEERING HANDBOOK *by Richard Y. Case. Charles R. Weimar, U. S. Rubber Co., Rockefeller Center, New York 20, N. Y. Price $3.50. 189 pp.*

The purpose of this handbook is to provide machine designers with engineering data necessary for the use of timing belt drives in new or redesigned machinery or equipment.

Correction

John Wiley and Sons, Inc., 440 Fourth Ave., New York, N. Y. published "Statics and Strength of Materials" by Roland H. Trathen. The book was not published by the author as erroneously implied in the review, July 1954.

THE TOOL ENGINEER'S *Service Bureau*

TRADE LITERATURE CURRENTLY OFFERED BY THE TOOL ENGINEER ADVERTISERS

Literature Number	COMPANY	DESCRIPTION
A-9-278-1	Ace Abrasive Laboratories	**Diamond Abrasives**—Catalog No. T-1 describes diamond powders, lapping compounds and tools. (Page 278)
A-9-281	Air Conversion Research Corp.	**Coolant Systems**—Literature describes Lo-Jet Acro unit and tells how to increase profits and production. (Page 281)
A-9-253	The American Brass Co.	**Drawing Brass**—Publication B-39 gives forming and finishing suggestions for brass. (Page 252-253)
A-9-176	American Broach & Machine Co.	**Rotary Broachers**—American Circular 300 gives data on standard American Vertical Hydraulic Surface Broaching Machines. (Page 176)
A-9-13	American Drill Bushing Co.	**Drill Bushings**—New ordering methods are described in three new catalogs. (Page 13)
A-9-230	American MonoRail Co.	**Cranes**—Bulletin C-1 discusses space saving, variability of jobs, and low maintenance cost of MonoRail Cranes. (Page 230)
A-9-10	The American Tool Works Co.	**Lathes and Radial Drills**—Bulletin 35 shows many examples of machining time reductions with American machines. (Page 10)
A-9-203	Ampco Metal, Inc.	**Ampco Metal**—Literature describes benefits and machining features of Ampco Metal. (Page 203)
A-9-274	Armour and Co.	**Abrasive Components**—Individual booklets are available on Armour back-up pads, storing abrasives and the back-stand belt method. (Page 274)
A-9-277	The Atrax Co.	**Carbide Tools**—New 88-page manual and catalog of carbide tools discusses the advantages of Atrax tools. (Page 277)
A-9-162	The Bellows Co.	**Drill Units**—A booklet shows how and where the Bellows unit can be used to best advantage. (Page 162)
A-9-250	Besly-Welles Corp.	**Taps**—"Handbook for Tap Users" contains information on tapping methods and tap selection. (Page 250)
A-9-206	Brown & Sharpe Mfg. Co.	**Automatic Screw Machines**—New catalog describes B & S automatic screw machines. (Page 205-206)
A-9-279	Brush Electronics Co.	**Surface Finish Instruments**—Booklet describes surface finish control and points out advantages of "Surfindicator" instrument. (Page 279)
A-9-29	The Cincinnati Shaper Co.	**Shears**—Catalog S-6 discusses advantages of Cincinnati shears. (Page 28-29)
A-9-146	Cleveland Tapping Machine Co.	**Ream-Tap Machine**—Catalog TE-94 gives production data and describes this combination head. (Page 146)
A-9-131	Detroit Stamping Co.	**Toggle Clamps**—Catalog discusses De-Sta-Co Models 507 and 509. (Page 131)
A-9-119	H. E. Dickerman Mfg. Co.	**Die Feeds**—The entire Dickerman line of die feeds is described in various offerings of literature. (Page 119)
A-9-132	Ettco Tool Co., Inc.	**Tapping Machines**—Bulletin 72A describes a combination tapping machine, head and work holder units. (Page 132)
A-9-287	Ex-Cell-O Corp., Continental Tool Works Div.	**Counterbores**—New catalog points out insertion and cutting advantages of Continental tools. (Page IBC)
A-9-151	A. B. Farquhar Div., The Oliver Corp.	**Hydraulic Presses**—Catalog shows presses in all sizes and capacities for all types of industry. (Page 151)
A-9-155	Fray Machine Tool Co.	**Milling Machines**—Circular 7 completely describes the Fray Mills. (Page 155)
A-9-193	Giddings & Lewis Machine Tool Co. Davis Boring Tool Div.	**Boring Tools**—New spherical boring tool and complete line are described in Catalog 304. (Page 193)
A-9-247	Gisholt Machine Co.	**Automatic Lathe**—Catalog shows how Simplimatic lathe can save money for users. (Page 247)
A-9-168	Hannifin Corp.	**Air and Hydraulic Units**—"High-Power Hydraulics" is useful for designing air and hydraulic units. (Page 168)
A-9-221	The Hartford Special Machinery Co.	**Drilling Machines**—Bulletin UM-100 gives complete information and specifications for universal drilling machines. (Page 221)

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TRADE LITERATURE CURRENTLY OFFERED BY THE TOOL ENGINEER ADVERTISERS

Literature Number	COMPANY	DESCRIPTION
A-9-269	Ingersoll Milling Machine Co.	**Milling Cutters**—Catalog 60F describes inserted blade face mills, end mills, helical slab mills, side mills, arbor cutters, angular cutters, and boring heads. (Page 269)
A-9-213	The Jacobs Mfg. Co.	**Collet Chucks**—Catalog 54-CC shows a construction and various applications of Jacobs chucks. (Page 212-213)
A-9-136-2	The Johnson Gage Co.	**Thread Gages**—New illustrated literature explains how to get maximum thread control at lowest costs. (Page 136)
A-9-195	Jones & Lamson Machine Co.	**Die Heads and Chasers**—Operator's Manual for tangent die heads explains construction and application of tangent chasers. (Page 195)
A-9-216-2	Kaufman Mfg. Co.	**Tapping Machines**—Catalogs 754 and 1153 describe the Kaufman tapping machines. (Page 216)
A-9-27	Kearney & Trecker Corp.	**Special Machinery**—Data sheet No. 1036 gives all details for Four-Station Rotary Transfer Machine. (Page 26-27)
A-9-8	Landis Machine Co.	**Threading Machine**—Complete information on Landmaco threading machine is given in Bulletin H-45. (Page 8)
A-9-12	The Lapointe Machine Tool Co.	**Broaching Machines**—Bulletin 5 points out machining advantages of Lapointe broaching machines. (Page 12)
A-9-182-2	Louis Levin & Son, Inc.	**Drills**—Bulletin N lists sizes and prices of stock drill and micro-drilling equipment. (Page 182)
A-9-199	Lodding, Inc.	**Jig and Fixture Components**—Catalog describes component and includes full-scale layouts of all Lodding fixtures. (Page 199)
A-9-153	Magna Driver Corp.	**Power Screwdrivers**—Folder 95E gives information and prices for the "Magna Finder" tool. (Page 153)
A-9-242	Metal Carbides Corp.	**Carbides**—New 84-page catalog 54-G points out the advantages obtainable with Talide carbides. (Page 242)
A-9-149-2	Morton Machine Works	**Fixture Clamps and Details**—Illustrated catalog No. 4 contains full-size tracing templates of each product. (Page 149)
A-9-202	National Broach & Machine Co.	**Gear Shavers**—Bulletin S53-7 gives all conception facts and cost savings possible with these machines. (Page 202)
A-9-215	New Britain Machine Co., Lucas Machine Division	**Horizontal Boring Machines**—Close tolerances and economies possible with Lucas machines described in catalog. (Page 215)
A-9-140	Oakite Products, Inc.	**Industrial Cleaning Equipment**—24-page booklet describes cleaners, precleaners and paint strippers. (Page 140)
A-9-133	The Parker Stamp Works, Inc.	**Marking Dies**—36-page catalog "Marking Tools" gives users necessary information for the use of marking dies. (Page 133)
A-9-134	Reed Rolled Thread Die Co.	**Thread Rolling Attachments**—Bulletin 1-21 states the nomenclature and possible savings with attachments for automatic screw machines. (Page 134)
A-9-267	Simonds Saw and Steel Co.	**Metal Saws**—Bulletin M-80 gives detailed explanation of Simonds Saws. (Page 267)
A-9-128-1	South Bend Lathe	**Lathes**—New catalog 5406 shows lathes, drill presses, shapers and pedestal grinders. (Page 128)
A-9-141	The S-P Mfg. Corp.	**Hydraulic Cylinders**—Catalog 104 shows the construction and tells of advantages of S-P units. (Page 141)
A-9-197	Sundstrand Machine Tool Co.	**Mill Components**—"Engineered Milling Production" explains how Sunstrand solves milling problems. (Page 196-197)
A-9-264	Vascoloy-Ramet Corp.	**Toolholders and Carbide Blanks**—Catalog and pricelist VR-436 tells of economies possible with insertion type toolholders and "Throw-Away" blanks. (Page 264)
A-9-191	The Yoder Co.	**Tube Mills**—Booklet explains electric-weld tube making and answers questions of interest to prospective buyers. (Page 191)

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Who's Meeting - and Where

Sept. 11-26. Swiss National Fair. 35th annual exposition, Lausanne, Switzerland. Complete information available from Consulate of Switzerland, 75 E. Wacker Dr., Chicago 1, Ill.

Sept. 13-24. Instrument Society of America. First International Instrument Congress and Exposition, Convention Hall and Commercial Museum, Philadelphia, Pa. More details are available from society office, 1318 Allegheny Avenue, Pittsburgh, Pa.

Sept. 14-23. Fourth European Machine Tool Exposition, Milan, Italy. For all details concerning the show, write to Dr. Ing. Enrico Brivio, general commissioner, Unione Costruttori Italliani Machine Utensili, Via Gaetano Giardino, 4, Milan, Italy.

Sept. 15-18. National Metal Trades Association. Plant management conferences, Sagamore Hotel, Bolton Landing, Lake George, N. Y. Association office, 122 S. Michigan Ave., Chicago 3, Ill., can supply more information.

Sept. 15-22. Society for Experimental Stress Analysis. Annual meeting and joint session with first International Instrument Congress & Exposition, Bellevue Stratford Hotel, Philadelphia, Pa. Get complete information from society—P. O. Box 168, Cambridge 39, Mass.

Sept. 22. Cutting Tool Manufacturers Association. Fall meeting, Lochmoor Club, Detroit, Mich. Write association office, 416 Penobscot Bldg., Detroit 26, Mich., for more facts.

Sept. 23-26. Packaging Machinery Manufacturing Institute. Twenty-second annual meeting, Grove Park Inn, Asheville, N. C. Direct inquiries to institute office, 342 Madison Ave., New York 17, N. Y.

Sept. 27-28. Steel Founders Society of America. Fall meeting, The Greenbrier, White Sulphur Springs, W. Va. Society office, 920 Midland Bldg., Cleveland 15, Ohio, can provide details.

Sept. 27-30. Society of Industrial Packaging & Materials Handling Engineers. Annual exposition, Colise-

um, Chicago, Ill. Contact society office, 20 W. Jackson Blvd., Chicago 4, Ill., for more information.

Sept. 28-Oct. 1. ASSOCIATION OF IRON AND STEEL ENGINEERS. Annual meeting, Cleveland Public Auditorium, Cleveland, Ohio. Get more facts from association headquarters, 1010 Empire Bldg., Pittsburgh 22, Pa.

Sept. 30-Oct. 2. PORCELAIN ENAMEL INSTITUTE, INC. Annual meeting, The Greenbrier, White Sulphur Springs, W. Va. Get details from Institute office, DuPont Circle Bldg., Washington, D. C.

Oct. 1-2. STANDARDS ENGINEERS SOCIETY. Annual meeting, Haddon Hall, Atlantic City, N. J. Write to society office, P. O. Box 281, Camden, N. J. for further information.

Oct. 4-9. SOCIETY OF AUTOMOTIVE ENGINEERS. National aeronautic meeting, Statler Hotel, Los Angeles, Calif. Contact society office, 29 W. 39th St., New York 18, N. Y. for details.

Oct. 4-6. NATIONAL ELECTRONICS CONFERENCE. Sponsored by AIEE, IRE, Illinois Institute of Technology, Northwestern University and University of Illinois. Hotel Sherman, Chicago, Ill. Send inquiries to AIEE office, 36 W. 46th St., New York 36, N. Y.

Oct. 12-15. NATIONAL ASSOCIATION OF CORROSION ENGINEERS. Annual south central regional conference. Adolphus Hotel, Dallas, Texas. Write association office, 1061 M & M Bldg., Houston, Texas, for more details.

Oct. 11-15. AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Fall general meeting, Morrison Hotel, Chicago, Ill. For more information contact institute office, 36 W. 46th St., New York 36, N. Y.

Oct. 14-15. ILLINOIS INSTITUTE OF TECHNOLOGY. Tenth annual National Conference on Industrial Hydraulics, Sheraton Hotel, Chicago, Ill. Direct inquiries to Institute, Technology Center, 35 W. 33rd St., Chicago 16, Ill.

Oct. 18-19. AMERICAN SOCIETY OF MECHANICAL ENGINEERS and American Society of Lubrication Engineers. Joint lubrication conference, Lord Baltimore Hotel, Baltimore, Md. Direct inquiries to D. F. Wilcock, General Electric Co., General Engineering Laboratory, 1 River Rd., Schenectady, N. Y., or to the ASLE, 84 E. Randolph St., Chicago 1, Ill.

Oct. 21-22. ILLINOIS INSTITUTE OF

TECHNOLOGY. Fifth annual National Noise Abatement Symposium, to be held on the Institute's campus, Chicago, Ill. Get more details from Institute office: Technology Center, 35 W. 33rd St., Chicago 16, Ill.

Oct. 21-23. AMERICAN SOCIETY FOR QUALITY CONTROL. Eighth New England Conference, Ten Eyck Hotel, Albany, N. Y. For additional information contact Southern Connecticut Section, ASQC, Box 1681, Bridgeport 1, Conn.

Oct. 25-27. AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Machine Tool Conference, Statler Hotel, Detroit, Mich. Direct inquiries to institute office, 36 W. 46th St., New York 36, N. Y.

Oct. 25-29. X-RAY DIFFRACTION SCHOOL, held annually by Research & Control Instruments Div., North American Philips Co., Inc. to be conducted at the Kickerbocker Hotel, Chicago, Ill. Will cover power camera, X-ray Diffractometer and X-ray Spectrograph techniques. Get details from company, 750 S. Fulton Ave., Mount Vernon, N. Y.

Nov. 1-5. AMERICAN SOCIETY FOR METALS. Metal Show, International Amphitheatre, Chicago, Ill. Get more data from society headquarters, 7301 Euclid Ave., Cleveland, Ohio.

Nov. 1-5. AMERICAN WELDING SOCIETY. National fall meeting, Sherman Hotel, Chicago, Ill. Further details are available from society office, 33 W. 39th St., New York 18, N. Y.

Nov. 2-3. INDUSTRIAL FURNACE MANUFACTURERS ASSOCIATION. Sponsors of sessions on practical industrial heating coincidentally with National Metals Congress and Exposition, Chicago. Request details from association office, 412 5th St., N.W., Washington 1, D. C.

Nov. 3-4. INVESTMENT CASTING INSTITUTE. National meeting, Congress Hotel, Chicago, Ill. For complete details contact institute headquarters, 27 E. Monroe St., Chicago 3, Ill.

Nov. 4-7. NATIONAL TOOL & DIE MANUFACTURERS ASSOCIATION. Annual convention, Biltmore Hotel, Dayton, Ohio. Complete information may be had from association headquarters, 907 Public Square Bldg., Cleveland 13, Ohio.

Nov. 15-17. AMERICAN STANDARDS ASSOCIATION. Fifth national conference on standards. Hotel Roosevelt, New York, N. Y. For more information, contact association headquarters, 70 E. 45th St., New York 17, N. Y.

Technical Shorts...

Nylon for Outdoor Uses

APPLICATIONS INVOLVING prolonged outdoor exposure may be checked for molded nylon with the discovery of a new formulation of Zytel nylon resin which is resistant to ultraviolet degradation. The material, which was created by the Polychemicals Dept. of the Du-Pont Co., appears to be readily moldable with good gloss, free from smears and dull spots. Its basic properties seem comparable to the earlier general purpose Zytel 101 which has been widely utilized for gears, bearings and complex shapes.

Manufacturers see a future for the substance in those areas when an end product involves outdoor exposure as agricultural machinery, sporting goods, toys and electrical equipment. In addition, the weathering ability property is expected to add impetus to the expanding use of this material in the automotive field.

Appearance of the "outdoor" nylon is jet black.

* * *

Titanium Alloy For Weapon Manufacturing

WHAT IS CONSIDERED a potentially suitable light-weight replacement for steel in military weapons has been developed for the Ordnance Corp. by Armour Research Foundation of Illinois Institute of Technology. Material fabricated is a light-weight titanium alloy which, if used in manufacture of heavy weapons and tanks, would greatly increase their mobility. Studies made during the experimentation revealed that the titanium alloy is 40 percent lighter in weight than high-strength steel. Further tests indicated that it is highly corrosion resistant and its properties compare favorably with those of steel used in such manufacture.

Complete assurance that the titanium alloy is the acceptable substitute first tests indicate, requires considerable further examination. However, the alloy is believed by Ordnance to be a potential substitute for steel in many ordnance components.

Statistics so far determine the properties to be up to 192 psi tensile strengths, which is approximately 42,000 psi stronger than any commercial alloy of titanium presently produced.

* * *

Automatic Inspection for Production

SIMULTANEOUS APPLICATION of ultrasonics and digital automation has been incorporated in precision instruments for the first time to create tools for parts inspection on a production line basis. This instrument, developed by Sperry Products, Inc. derives its name, Simac, from its sonic inspection measurement and control function. Primarily, the tool, which cost $300,000, was created to inspect jet engine rotor forgings and other unfinished engine parts.

In operation, it beams ultrasonic waves at a speed of 5,000,000 sound vibrations per second into the specimen which is mounted on a rotating turntable immersed in water. Sequence of

the ... is automatic. The beams are reflected by structural discontinuities, which may be defects, are logged on a circular chart which becomes a record to aid interpretation and filing. This detection of defects in advance of machining offers obvious advantages economically.

Sequence of the work involves aligning the part to a jigging plate on the accessory setup table. It is then transferred to the turntable of the scanning machine, where it is immersed in water in the tank. Water serves as an efficient conductor of ultrasonic waves between search unit and the part undergoing inspection. A series of scan lines is then developed in carefully controlled sequence until the entire volume of the specimen has been penetrated by the beams. The unwanted discontinuities within the material reflect these beams as "echo" signals.

Series of holes punched in a tape act as a guide for the servo-motor which controls motion of the scanning head—horizontal, vertical and angle of inclination. Thus creating an original method of controlling sequence of the scan lines.

* * *

Miller Extensions

INCREASE IN EFFICIENCY and capacity of a portable hydraulically driven milling machine has been the result of ingeniously devised work ways for units used aboard carriers at Puget Sound Naval Shipyard. Two 30-foot rails of railroad iron were utilized as machine ways to straddle the cut to be made. Thus a 30-foot cut could be made during a single setup without moving the carriage rails, and only three setups were required for the total 90 feet to be cut. Setup time was reduced about 40 percent.

* * *

Hydraulics Study Set

RESEARCH in the field of hydraulics and hydraulics machinery will be furthered as a consequence of the $6,000 grant set up for that purpose at Illinois Institute of Technology by the Giddings and Lewis Machine Tool Co. One third of the grant will cover a fellowship, while the remainder will be used to further research at the school.

First recipient of the graduate research fellowship is Charles A. Sotich. Mr. Sotich received his mechanical engineering degree from Illinois Tech last June.

Men at Work . . .

At its recent meeting, stockholders of National Tool Co. elected two vice-presidents to the management staff. **Raymond D. Lindstrom,** previously factory manager, was made vice-president—manufacturing. **Joseph B. Clough,** who has been director of sales since 1950, was elected vice-president—sales. Mr. Clough is a member of ASTE's Cleveland chapter.

A new slate of corporate officers has been announced by Chicago Molded Products Corp. **Edward F. Bachner, Sr.** assumes the newly created post of chairman of the board; **Marcel F. Bachner,** formerly vice-president and treasurer, is now president and treasurer; and **John J. Bachner is** now executive vice-president and general manager.

Two executive promotions at The Carpenter Steel Co. included **Douglas R. Beggs** who became assistant to the vice-president—production; and Harold W. Miller, who was made chief plant engineer. Mr. Beggs was formerly director of personnel, while Mr. Miller was previously assistant general superintendent.

Also announced by Carpenter Steel was the appointment of **Carl B. Post** to head the metallurgical and research departments. Dr. Post, who has been chief metallurgist of the company since 1951 is known for his extensive work with automotive and aircraft valve steels.

The board of directors of Tomkins-Johnson Co. has elected **Dorothy M. J. Tracey** president of the company to succeed her father, A. R. Johnson, who died last spring. For a number of years, Mrs. Tracey has served as executive vice-president and general manager of the organization.

Wesson Co. has announced appointment of **Paul H. Miller,** research engineer, to its research and development staff. Mr. Miller, who was one of the pioneers in carbide cutting tool application, will assist in creation of tools and products for new metalworking applications, and will also conduct research into expanded applications of carbide tooling.

E. T. Walton, who has been chief metallurgist at Crucible Steel Co. of America's Midland, Pa., Works, has been appointed to its central metallurgical offices in Pittsburgh as metallurgical engineer. **J. D. Dickerson,** chief metallurgist at the Midland Works has been named to assume Mr. Walton's former duties. At the same time, **Charles W. Schott,** who has been associated with United States Steel Corp., was named plant metallurgist at Midland.

At the recent meeting of the Alloy Casting Institute, **C. K. Lockwood** and **Thomas Rutherford** were elected to serve as president and vice-president respectively for the coming year. Mr. Lockwood is vice-president of the Stainless Steel & Alloy Div., Shawinigan Chemicals Ltd., and Mr. Rutherford is associated with The Midvale Co.

William L. West has been elected president of Torit Manufacturing Co. He joins Torit after 15 years with the Automatic Control Co. where he served first as treasurer and, for the past eight years, as president.

T. R. Gill is now president and a member of the board of both The General Supply Co. and The G. S. Equipment Co. Also, vice-president of The Singleton Co., he is general manager and a director of all three companies.

C. I. Bradford, vice-president and director of operations of Rem-Cru Titanium, Inc., is now president of the company and a member of the board. He succeeds Walter U. Reisinger who has announced his retirement.

William Irrgang is the newly elected president and general manager of The Lincoln Electric Co. Familiar with various phases of plant operation, engineering and management, he has been executive vice-president.

Michigan Powdered Metal Products Co., Inc., has announced the election of V. **Leonard Hanna** as a director as well as treasurer of that firm, replacing Jules F. Halm who retired.

Announcement from Colonial Broach Co. has revealed the appointment of **Charles H. Crawford** to the post of plant manager. Mr. Crawford joins Colonial Broach after 34 years with Mack Truck Co. where he was plant manager of that firm's New Brunswick, N. J. facility.

P. L. Coddington has been named general manager of Alloy Tube Div. of Carpenter Steel Co. He has been assistant to the company president since August 1953, prior to which time he was manager of sales at the same division.

The Cincinnati Shaper Co. has revealed the appointment of **Frank Pfefferle** to fill the position of special projects manager. His new duties will involve special work primarily in the fields of new product development and market research.

Three promotions in the Carbide Div. of Firth Sterling Inc. were recently announced. **M. L. Backstrom,** previously chief engineer for the company, is now assistant sales manager. He is succeeded in his former post by **W. E. Montgomery. John Gabrenas** was named to fill the position of assistant chief engineer.

William T. Cherry has been named to the position of manager of application engineering at Formsprag Co. He has been associated with the firm's production, engineering and sales departments for the past five years.

August B. Kinzel has been made director of research at Union Carbide and Carbon Corp. In his new capacity Dr. Kinzel is responsible for administration and coordination of research activities of all divisions of the company. Widely known for his work in research, he currently is also chairman of the Naval Research Advisory Committee and chief consultant in metallurgy to Los Alamos Laboratories and other units of the Atomic Energy Commission.

The Fellows Gear Shaper Co. has revealed the appointment of **Neal L. Cobb** as chief engineer for the firm. He had formerly been chief of tool design.

Peter J. Jensen is now manager of manufacturing at Carboloy Dept. of General Electric Co. With exception of his service in the Army Ordnance Corp., Mr. Jensen has been manager of Carboloy's Michigan sales district since 1948.

Paul A. Pierce is now manager of operations for Continental Foundry & Machine Co. Associated with the company since 1920, he most recently held the position of manager of foundries.

New officers were recently elected by the Illuminating Engineering Society to take office October 1. They include **Duncan M. Jones** of Curtis Lighting of Canada, Ltd., president; **Marshall N. Waterman** of Westinghouse Lamp Div., vice-president; **Kirk M. Reid** of General Electric Co., general secretary; **George J. Taylor** of Day Brite Lighting, Inc. is treasurer; and **R. F. Hartenstein,** Ohio Edison Co., is vice-president to serve the second year of a two-year term.

Eugene Parks is the new president of Fonda Gage Sales Corp. according to recent announcement. Prior to joining Fonda, Mr. Parks was associated with the Grotnes Machine Works, Inc.

Organizational changes at the Norwood Works of Allis-Chalmers Mfg. Co. have involved **Thomas C. Knudsen,** who has been made assistant to the general manager in charge of the mechanical product development laboratory; **Vernon B. Honsinger,** who now is assistant to the general manager in charge of the electrical product development laboratory; and **Dwight H. Lory,** who became manager of the company's Texrope Drive Section, a position formerly held by Mr. Knudsen. Mr. Honsinger was previously engineer-in-charge, research laboratory, while Mr. Lory has been assistant manager of the section he now heads.

ield Notes...

Steady rise in the demand for machinery and equipment to replace and supplement industry's capital equipment should be expected according to S. D. Maddock, president of C.I.T. Corp. Mr. Maddock pointed to the study by Machinery and Allied Products Institute which shows current replacement expenditures in industry are $10.4-billion annually. His forecast is that this figure will increase to $15-billion by 1960 and to $26.7-billion by 1975. His prognostication is based on the fact that about $60-billion worth of capital equipment in this country already is more than 10 years old now and the trend indicates that within two decades the figure will mount to $200 billion.

Mr. Maddock feels that the lag in modernization is caused by failure to understand that income-producing machinery can be purchased on terms which permit it to pay for itself due to the consequent increased earning capacity.

v v v

Official name of the Sales & Service Machinery Co., Inc. has been changed to Delaware Valley Machinery, Inc. This change will not affect either personnel or machine tool lines represented, since the alteration is aimed only at avoiding confusion with other organizations that bear similar names, company officials stated.

larger quarters

When completed, the new building now under construction for Michigan Drill Head Co. will more than double that firm's productive capacity. The facilities housed will include the latest developments in equipment handling machinery as well as accommodations for an expanded inspection program. The building, where operation is expected to begin October 1, is adjacent to the Hoover Road area of Detroit.

v v v

New and larger manufacturing facilities have been acquired by Warner Div. of Detroit Harvester Co. The new plant, located at 14300 Tireman Ave., Detroit 28, Mich. will permit an increase in production of hydraulic units of the company's own design plus allowing Warner to take on additional subcontracting work for aircraft and ordnance plants.

Construction is under way on the new factory and general office building for Wilton Tool Mfg. Co. Inc. at 9525 Irving Park Rd., Schiller Park, Ill. The expansion program, which will cost approximately half a million dollars when completed, will be ready for production in January of 1955.

v v v

Fifth expansion in the past eight years has been completed by Blue M. Electric Co. with the erection of a new

modern plant in Blue Island, Ill., a Chicago suburb. Unusual feature of the facility is its electrical installation which permits testing and operation of more than 137 laboratory units simultaneously.

new ventures

Copper and brass warehousemen, working through their trade association, have organinzed a free service which is expected to ease many bottlenecks for their customers. Effect will be a pool of information on hard-to-get items, thus if such an item exists anywhere in the United States, a user should be able to get it in little more than a week. This will undoubtedly work to cut lead time on production schedules. Since practically all copper and brass warehousemen in this country are members of the association, this plan virtually places the entire stock of every warehouseman in the country at the disposal of every other warehouseman.

v v v

Industrial users of diamond dust are offered a chemical service by Astra Corp. of Cleveland. This company agrees to take the waste material such as cloth strips, grinding wheel sludge, cotton batten etc. containing diamond dust and processing it so that 60 to 95 percent of the diamond dust is reclaimed. Including reclamation cost, the process is said to make a saving of from 30 to 50 percent possible for the companies so served.

Automation of manufacturing process is the concern of the new y organized Control Products Co., Inc. The firm will design and manufacture automatic control systems for the steel, nonferrous, electrical, oil, chemical and other process industries.

Wallace E. Powell, formerly a control systems engineer for Jones & Laughlin Steel Corp., is president of the firm.

v v v

Production is now under way at Rocky Mountain Metals, Inc. in Colorado Springs, Colo., a subsidiary of the International Powder Metallurgy Co. The plant was established to meet growing demands for powder metal parts while providing better and more economical service to industry west of the Mississippi. It is equipped with the most modern engineering, research and production facilities and is geared to produce parts for military, industrial and consumer products.

v v v

Both flexibility and comprehensiveness are offered in the financing and leasing plan outlined by Jones & Lamson Machine Co. for machine tool users who are anxious for new equipment but hesitant over cost. The merchandising programs, worked out by J & L with C.I.T. Corp. industrial financing firm, feature a true lease plan running for periods up to nine years, and an installment financing plan with five-year terms. There is also a leasing plan which permits an option to buy.

mergers

Stockholders of Olin Industries, Inc. and of Mathieson Chemical Corp. have voted to approve merger of the two companies to form a new corporation, Olin Mathieson Chemical Corp. After the merger, John M. Olin, president of Olin Industries, will be chairman of the board of the new firm, while Thomas S. Nichols, president and chairman of Mathieson, will become president. At present, plans for the new company do not indicate changes in basic operations.

v v v

Machinery and equipment of American Tool Works of Hartford, Inc. have been purchased by The Newton Co. According to the announcement of the purchase, the facilities will be moved from the Hartford location to the New-

ton plant in Manchester. Among former officers and management of American Tool Works joining Newton are John Sundkvist, founder, who will act as a consultant, Norman Nelson, who will remain as sales manager, and Edward Wild who will continue as superintendent of the production department.

expansions

Work has started on the million-dollar plant addition at Carboloy Dept. of General Electric Co. The unit, to be completed this fall, will accommodate new engineering and manufacturing equipment while allowing rearrangement of other facilities to make still more vacated space available for advanced engineering activities.

V V V

An additional building which will be devoted entirely to new machinery and equipment for manufacturing grinding chips and compound has been acquired by the Roto-Finish Co. The extra unit is expected to increase production facilities and permit greater flexibility in handling and delivering of orders.

V V V

Robertshaw-Fulton Controls (Canada) Ltd. has acquired a modern manufacturing plant in the Toronto area and will start operations late this summer. This company, which was formed last spring, will assemble and manufacture thermostatic controls for Canadian customers.

V V V

Branch office of Aluminum Ltd. Sales, Inc., U. S. distributor for Aluminum Co. of Canada has been opened to meet demand by Michigan independent fabricators for Canadian aluminum. The office is located in the Curtis Bldg., 2842 W. Grand Blvd., Detroit, Mich.

V V V

The Eaton Screw Products Co. plant in Eaton, Ohio, recently completed by The Parker Appliance Co. is now in full operation. The plant has more than tripled the company's manufacturing space.

V V V

Two plants which will serve as major facilities for its Chemical Specialties Div. have been started by Pennsylvania Salt Mfg. Co. The facilities, located in Delaware, Ohio, and Chicago

Heights, Ill., will serve as primary regional blending, packaging, warehousing and distribution centers. Construction of both units is expected to be completed this year.

new divisions

Recent establishment of an Aircraft Products Div. has been announced by The Denison Engineering Co. The new division will sell, service and manufacture items for sale to both military and commercial aircraft industry. Edwin L. Shaw, who has broad experience in aircraft component development with Denison, has been named head of the division.

v v v

Solar Steel Corp. has established a new steel department at its steel warehouse at Union, N. J. to supply that sales area with hot rolled plates, structural shapes, bars and bar shapes. J. Harry Horstmann, former vice-president of Albot Steel Co. and with 41 years of steel experience, has joined Solar to manage the new department.

v v v

Formation of a new application engineering division within its engineering department has been revealed by Morse Chain Co. to meet application engineering requirements of its line of overload protection devices, cam clutches and couplings. Ralph E. Cherry, former executive engineer of the Morse Detroit plant will head the division, while Earle E. Wesselhoff, previously assistant chief engineer on special assignment, has been made assistant chief engineer in charge of development, production engineering and the Detroit engineering laboratories.

v v v

Formation of a chemical and metallurgical division within the General Electric Co. has been announced by Robert Paxton, executive vice-president. The new division, which includes the former Chemical Div. and the Carboloy Dept, is made up of five operating departments: Carboloy, Plastics, Silicon Products, Chemical Materials and Laminated and Insulating Products. Robert L. Gibson is its general manager.

v v v

Two new engineering departments have been established at American Machine & Foundry Co. Known as the advanced development engineering and

the Buffalo product engineering departments, they replace the former engineering department located at the company's Buffalo plant. Robert L. Holloway, formerly chief engineer at the Buffalo plant has been named chief engineer of the advanced engineering department, while Herbert E. Oles, who was section manager of product engineering of the old engineering department is now chief engineer of the Buffalo product engineering department.

research

A **Tool Steel Research** Div. has been formed by Crucible Steel Co. of America within its sales department. It will be headed by M. E. Cummings who resigned his duties as assistant vice-president of operation to take over the directorship of the new activity. Purpose of the division is to assist users of tool steels in proper selection and handling of various types; to promote development of improved or new grades; and to increase performance or to meet new applications as they arise.

v v v

Establishment of a special research-consultant group within its industrial division has been announced by Permatex Co., Inc. The move was carried out in order to expedite handling an enlarged volume of joint research programs aimed at development and test of sealing compounds. This consulting research group is to be headed by Wallace M. Langton and A. J. Bevalac.

v v v

A long range program in the electronic and guided weapons field has been inaugurated by the Winder Aircraft Corp. The firm stated that contracts now in production and in preparation carry through most of 1955. It has current manufacturing contracts with the U.S. Air Force and the U.S. Army for specialized electronic products as well as supply contracts with both service branches.

v v v

Construction is under way on a new research center for Jones & Laughlin Steel Corp. The laboratory, which is scheduled for completion by mid-1955, is located on Baldwin Hill, overlooking J&L's Pittsburgh Works. Costing initially more than $1½-million, the unit will consist of several buildings, and house a research staff of about 100 persons.

technical

Process Revision Cuts Manufacturing Costs

by Walter H. Friedlander
Partner
Metcut Research Associates
Cincinnati, O.

ALL MANUFACTURING OPERATIONS require periodic changes to eliminate sporadic trouble spots or to permit engineering changes in material, tolerances, or heat treatment. If the entire line is re-evaluated from receiving to shipping, major savings in manufacturing cost are often realized.

For example, a process analysis in one plant showed that a hand-chipping operation requiring several minutes was holding up the line. It was found that an additional tool applied during a previous automatic turning operation, could produce an undercut that would eliminate the manually paced operation. Since the undercut was placed on a locating surface that was machined off anyway, the change was acceptable to engineering. The saving amounted to $50,000 per year.

Such a study is best carried out in two stages: (a) An investigation of the records, and (b) a check on the production floor of actual methods and facilities being used.

How to Make a Study

First, the operations sheet should be checked and a flow chart of the sequence of operations prepared to see if operations can be combined, reshuffled, or eliminated. Next, a check must be made of the tool setups and tool prints to gain a complete understanding of present part manufacture. When available, tool-life records should be looked into to find spots where undue tool wear or tool breakages occur. The inspection records should be checked to find major causes, frequency, and amounts of rejection and rework. The part print should be gone over in detail and engineering changes studied to see if recommendations can be made concerning material specifications, tolerances and surface finish requirements. A recommendation to change the material, for instance, might call for the substitution of a free-machining steel. Possible changes in tolerances and finish requirements may ease manufacturing problems and reduce the number of rejects. In addition, the standards must be evaluated to check job procedure. Finally, plant layout must be studied and equipment maintenance records must be obtained. The latter will influence decisions regarding possible machine replacement and recommendations concerning preventive maintenance.

Next, the study concerns itself with an investigation of facilities and actual methods on the production floor. Here, layout must be checked again for accessibility, aisle space, and parts-in-process handling and storage facilities. Then, the equipment must be gone over to obtain an idea of the accuracy that can be obtained with machines and man-machine combinations.

Next, a check must be made to see if the operations sheets are up to date and being followed, and if each job is done as set up in the standard. Also, tool supply and tool grinds should be investigated, and production gages and inspection methods must be correlated with those of the inspection department so that maximum uniformity can be attained. At times, the inspection methods employed by the production and inspection departments may vary to such an extent as to cause large amounts of rejection.

Durinng this time, interviews should be held with all of the personnel affected to bring out difficulties and to obtain their ideas on possible improvements. When all of the data have been collected, an analysis must be made. Then a report, complete with cost estimates, should be prepared and presented to the general manager for review.

The task of translating recommendations into effective improvements requires the cooperation of all the departments affected. This is best done by giving the report to a committee consisting of representatives of each of these departments. Each representative can act as liaison engineer to his particular group. If, for instance, it has been recommended to loosen the tolerance to a certain dimension, the engineering representative can expedite the engineering change request. Similarly, if critical cutting-tool shortages have

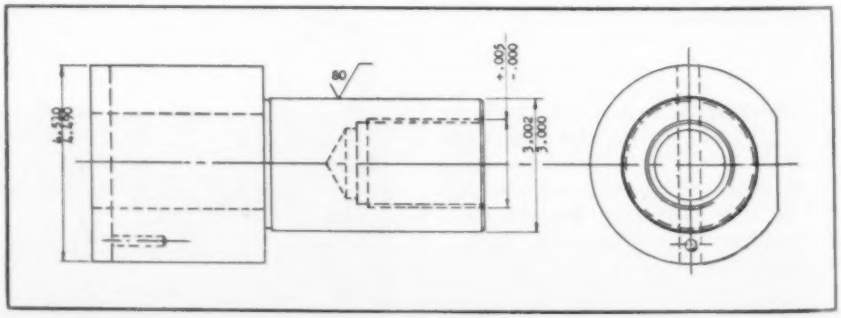

Fig. 1. Shaft forged of SAE 8640 exemplifies the need for periodic process review.

been discovered, the tool-control representative can investigate inventory practices and expedite the tools through the grinding room.

For the shaft shown in *Fig.* 1, when the part first was designed, it was the smallest of a series of three components which were manufactured from an identical forging. The company obsoleted the first two shafts; nevertheless, they continued to make this one from the old forging.

The original hardness specification called for Rockwell C 34-40 all over. Engineering finally reconsidered the part and came up with a hardness specification of Rockwell C 26-32 on the thread end only. Otherwise the forging was to be left as normalized.

Analysis of the process disclosed a number of possible simplifications evident from comparison of sequence of operations, shown in *Figs.* 2 and 3.

Flow charts can now be used to evaluate the savings. These, showing the original and revised sequences of operations, indicate that six operations have been eliminated, namely, the grinding, reaming, thread milling, cleaning and two inspection operations. Furthermore, an OD grinder, a drill press, and two thread millers have been replaced by one turret lathe. This is one of the two machines previously used for turning the small OD. It must be remembered that the forging change has reduced turning time appreciably

Fig. 2. Original sequence of operations performed on part shown in *Fig.* 1.

Operation No.	Operation Name	Machine	Department
5	Receive material		Receiving
10	Inspect		
15	Normalize		Heat-treat
20	Inspect		
25	Chuck on small OD, R & F turn large OD, and face end	Turret lathe (1)	General shop
30	Chuck on large OD, R turn, face end and shoulder, neck, drill, counterbore, chamfer, countersink	Turret lathe (2)	General shop
35	Inspect		
40	Mill side	Hor. milling mach.	General shop
45	Mill slot	Hor. milling mach.	General shop
50	Drill ¼-in. hole	Upright drill press	General shop
55	Inspect		
60	Induction-harden thread end	Induction-hardening	Heat-treat
65	Electrolytic clean		Heat-treat
70	Inspect		
75	Grind small diameter	OD grinder	General shop
80	Inspect		
85	Ream bore	Upright drill press	Gear department
90	Mill thread	Thread miller (2)	Gear department
95	Inspect		
100	Final inspect		
105	Slush		
110	Stores		Finish stores

Fig. 3. Sequence of operations performed on shaft after re-evaluation of process.

Operation No.	Operation Name	Machine	Department
5	Receive material		Receiving
10	Inspect		
15	Normalize and harden R 26-32		Heat-treat
20	Inspect		
25	Chuck on small OD, R & F turn large OD, and face end	Turret lathe (1)	General shop
30	Chuck on large OD, R turn, face end and shoulder, drill, and chamfer	Turret lathe (1)	General shop
35	Inspect		
40	Mill side	Hor. milling mach.	General shop
45	Mill slot	Hor. milling mach.	General shop
50	Drill ¼-in. hole	Upright drill press	General shop
55	Inspect		
60	Chuck on large OD, finish turn, counterbore, countersink, and tap	Turret lathe (1)	General shop
65	Inspect		
70	Final inspect		
75	Slush		
80	Stores		Finish stores

and that the neck has been eliminated. As far as handling is concerned, analysis shows that only four major moves occur under the present routing compared to the seven moves previously required.

Experience has shown that large savings in time, equipment, and personnel can be realized through the application of this type of survey. A periodic reevaluation of the manufacturing process tends to lead to a modern plant with minimum production problems and costs.

From a paper (54-SA-14) presented at the 1954 semiannual meeting of ASME.

▼ ▼ ▼

Why Industrial Pollution Control?

By Roy F. Weston

Sanitary Engineer
The Atlantic Refining Co.
Philadelphia, Pa.

To date, industry has spent a billion dollars or more for water pollution abatement facilities. It is estimated that 4 to 5 billion dollars additional will have to be spent in the next 10 years. Because little information is available relative to the solution of any specific problem, research is essential to supply feasible and economical solutions.

It is obvious that as our population grows and industry expands, there will be increasing competition for water of good quality. Current and estimated future requirements for water supply are shown in *Table* 1. The data show that industry itself will be a major competitor for clean water. The demand for more waters of recreational quality is also increasing. It may be expected that the use of natural waters for recreation will increase at a rate equal to if not greater than the rate of population growth.

While the demand for clean water is increasing, the amount of pollution being discharged is also increasing, *Fig.* 1.

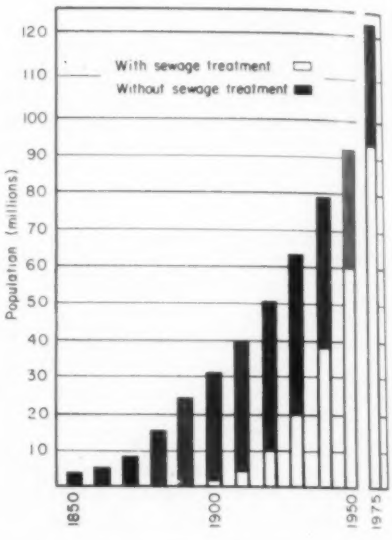

Fig. 1. Comparison of urban population growth with sewage treatment, projected to 1975.

Pollution loading is increasing at an accelerating rate. The current rate of construction of sewage treatment plants is not much more than that required to keep up with our increase in population.

If it is assumed that industrial pollution is proportional to industrial production, it can be seen, *Fig.* 2, that pollution has roughly doubled in the past 25 years (neglecting treatment). It can double again in the next 25 years.

Because municipalities and industries have abused their privilege of using natural waters for the disposal of their wastes and have interfered, unduly, with other legitimate water uses, the people have demanded the passage of laws establishing regulatory agencies and authorizing the promulgation of control rules and regulations.

The American people have spent the equivalent of $5,300,000,000 to provide treatment facilities for reducing pollution by municipal sewage. Unfortunately, specific information on the investment of industry in pollution control is unavailable. It is known that at least 2600 industrial establishments have already provided waste treatment. Those municipalities and industries

who have already abated pollution or who are in the process of doing so will protect their competitive positions and their investments by insistence that current pollutors meet the problem.

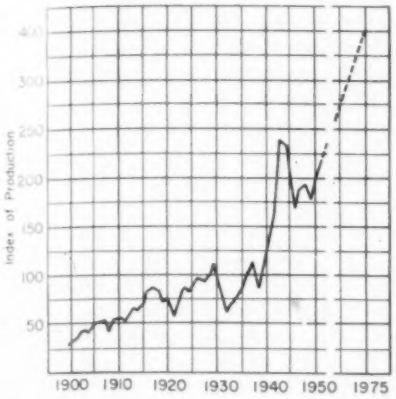

Fig. 2. Growth of industrial production in United States, projected to 1975.

The technical problems of industrial pollution control include the fields of chemistry, biology, physics, and the various engineering arts and sciences.

The need for continued expenditure of large sums for the abatement of pollution and the apparent need for the tightening of restrictions in the future, indicate the need of considerable fundamental research work.

Some of the general problems associated with pollution control that are in particular need of additional research are:

1. Development of general and specific sampling and gaging techniques and equipment and of methods for evaluating sampling and gaging data.
2. Improvement of analytical methods for chemical and biochemical oxygen demand, oil, phenolic type compounds, taste, toxicity to aquatic life, etc.
3. The development of special methods for reducing pollution by preventive measures.
4. The development of high capacity biological treatment processes and more efficient aeration equipment.
5. The investigation of various methods for concentrating, dewatering and disposing of sludges.
6. The development of procedures for the practical and equitable administration of pollution control.

The solution to these and related problems can be most economically achieved using the principles of industrial research.

From a paper given at the 1954 meeting of the American Institute of Chemical Engineers.

Table 1—Water Use in the United States—1950 and 1975

Use	Estimated Withdrawal 1950		Estimated Need 1975	
	Billion Gals. per Day	Percent of Total	Billion Gals. per Day	Percent of Total
Municipal & Rural	17	9	25	7
Direct Industrial	80	43	215	62
Irrigation	88	48	110	31
Total	185	100	350	100

Source of Data: "Resources for Freedom"

technical digests

Advantages of Inert-Gas Spot Welding

by C. A. McClean
Air Reduction Sales Co.

Inert-gas-shielded tungsten-arc spot welding provides the fabrication of light gage steels with a method of producing much the same type of joint as that obtained with instant spot welding without the need for a back-up as part of the welding tool and without forging pressure. The ability to work from one side only broadens the scope of spot welding as a fabrication method.

This investigation covers inert-gas-shielded tungsten-arc spot welding of materials as thin as 0.025 inch without back-up or special jigging. It covers the joining of tubular as well as flat sections and joining of dissimilar metals. The process is also considered as a secondary tool for tack welding prior to subsequent joining by other welding methods. Its use in this capacity can eliminate jigging or reduce it to a minimum.

This paper covers methods of determining welding procedures and of evaluating joint design and strength. The data are compared with corresponding resistance spot welding data. Practical job applications are included.

From a paper presented at the second annual welding show and 1954 meeting of the American Welding Society.

▼ ▼ ▼

Production Engineering Education Trends

by Prof. O. W. Boston
Chmn., Dept. of Production Engr.
University of Michigan

At every one of the impressively frequent meetings sponsored by the Armed Services and industry, there is constant demand for more effective and economical production. This nation is more the "arsenal of democracy" than when the phrase was coined, through no fault or choice of our own, and this admits of no delay in the attainment of the utmost possible perfection in manufacturing methods. The standard of living, the world over, is a most sensitive index of that same perfection of performance on the part of the production engineer. This implies the steady technological improvement which helps labor to produce more in shorter hours and at higher wages, as well as benefit to the consumer, in more abundant and perfect products, and at lower cost. In

spite of a growing understanding and acceptance of this point of view, academic education has been neglected.

Production Engineering Course

The undergraduate curriculum for the production engineering option may be divided into three parts:

Part 1 consists of the fundamental or preparatory courses, requiring substantially two years or four semesters.

Part 2 is devoted entirely to technical courses for some 50 credit hours required of all students. These include work in fundamental engineering subjects, including differential equations. Three courses cover basic processes for the production of metal parts including casting, plastic working and machining. Three additional hours are devoted to study of materials and 12 hours to the design of the product and equipment. Further courses cover business administration, principles of organization, economics and statistical methods.

Part 3 consists of options which enable the student to concentrate on the factors of production which interest him most. The student may use free electives for nontechnical courses or professional courses for further concentration.

Wide Range of Opportunity

This course, chiefly scientific in content, is designed to provide our tremendous manufacturing industry with men familiar with materials, tools, processes, and machines. With a short training period in the smaller companies, these men will be of immediate value. The very large companies have 1 or 2 year training periods to accommodate the large group of students employed each year from a number of schools with widely different types of courses. Some large companies report that the specialization in engineering is of no particular value to them, and that students with liberal arts degrees are as satisfactory as those technically trained. They, of course, have a great variety of positions in which to place the trainees. Statistics show that the majority of the technical graduates go with the smaller companies.

Design for production, processing of parts, selection and design of machines and cost estimating are promising fields, with supervision and management as likely goals. The welding, foundry, stamping, forging and plastic industries, and the tool and die shops, parts-manufacturing shops and those making instruments for measuring and

inspection, offer a limitless field for scientists and production engineers.

Three decades now, many letters from former students and representatives of industry have testified to the continuance and expansion of our production courses. The present Industrial Engineering course, as outlined, has been in effect only 2½ years but has an enrollment of about 10 percent that of the engineering college as a whole. Increasingly greater numbers are going on with their master's, professional or doctor's degrees. Scholarships are being provided by technical societies, industries and individuals. Production engineering is beginning to receive well-earned recognition.

From a paper (54-SA-8) presented at the 1954 semiannual meeting of the ASME.

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Use of Powdered Metal Electrodes

By J. E. Hinkel
The Lincoln Electric Co.

Both the users of welding and the manufacturers of welding equipment have reached a point in their knowledge of the arc-welding process where it is now practical and economical to use electrodes for manual arc welding that have powdered metal in their coatings. This is a milestone in the history of welding comparable to that marked by the step from bare to coated electrodes and the development of electrodes for a-c welding. With a-c welding current and powdered metal electrodes, there is a combination that makes for the fastest manual welding known.

These electrodes have outstanding advantages in speed of welding, smooth appearance, freedom from gouging and undercutting, excellent wash-in, easy slag removal and ease of operation. At present they are limited to downhand or nearly flat operation, although developments indicate that powdered metal coatings may be applied to out-of-position electrodes. With the availability of modern handling equipment, however, most welding can today be positioned for welding downhand. It is of less importance to have a completely versatile electrode.

The electrodes have had some astounding results in production welding applications. They have been enthusiastically accepted by both operating personnel and management. They are destined to replace conventional electrodes in many applications.

From a paper presented at the 1954 spring meeting of American Welding Society.

Abstracts of FOREIGN LITERATURE

By M. Kronenberg
Consulting Engineer

Standardization of Lathe Swing and Tools

About 70 percent of German lathe manufacturers have supplied data on their lathes in a survey of results of attempts at standardizing the swing in relation to the tool size. C. H. Stau who summarizes the survey in the June issue of *Werkstatt und Betrieb* indicates that standardization in lathe design is far short of its goal.

In 1944 a tentative standard was prepared covering 16 swing values between about 11 inches up to 64 inches. Increments were established at intervals of $(10)^{1/20}$ which is equal to a factor of 1.125 or an 11-percent increase in the swing dimension. The author suggests adding some smaller and larger lathes to cover all possible cases.

Comparing the 1944 standard with the actual number of swings being built he finds that only 24 percent of all swings correspond to a standard, while 38 percent of the standard swings are unused. Similar discoveries were made when comparing the standard shank size with those that can be used on these lathes. The author found that, in his opinion, too many shank sizes are used, requiring unnecessary storage room, investment etc., which could be saved by standardization. He concludes that 40 percent of the shank sizes are superfluous. He also advocates dropping square shanks because they are weaker than rectangular shanks of the same cross sectional area. In this way, further savings could be realized. Standardization of the swing size would have relatively little effect on the standardization of the shank size. His conclusions are incomplete because lathes manufactured in other countries than Germany have been ignored in this analysis.

Spot Welding

W. Frank, describes in the same issue of *Werkstatt und Betrieb* the development of spot welding processes,

covering single point welding, multiple point welding and the buckle welding method. He gives highlights of the various processes, supplementing his information with numerous illustrations.

Shop Testing of Carbide Tools

Testing methods employed by manufacturers of carbide tools as well as results are usually unavailable to the user, according to M. Widmer writing in the Swiss magazine *Industrielle Organisation*, No. 6, 1954. He has therefore, developed a method for determining the relative merits of carbide tools purchased from various sources, based on wear resistance and bending strength of the tips. He says that his method has been successfully used by one of the largest corporations in Switzerland, a builder of heavy machines such as turbines and motors. Although relatively new, the tests have yielded appreciable savings. The cost per test run was about $20.

In his article Mr. Widmer describes procedure and instrumentation in detail, also reviewing other methods which were unsatisfactory. Since brittleness is the main reason for tool failures of carbides it would have been advisable to test it directly; it proved impractical to do so, because it is almost impossible to simulate actual shop conditions. He found, however, that the bending test yielded excellent results and agreed with shop findings so that the search for another method was abandoned. In addition wear tests were run by vibration, by measuring the crater of the face of the tool, and by determining the wear land, which is greatly affected by the cutting process.

Removing a given amount of cast iron from a selected test piece at predetermined cutting conditions by a turning operation and measuring the wear land produced, tested wear resistance. The test was repeated on steel, using the proper feed, spindle speed and tool geometry.

In this way, more than 100 different carbides were tested showing rather significant differences, disagreeing with standard numbers commonly used in Europe to designate various grades of carbides. As an example, the author claims that the G 1 carbides purchased from different manufacturers varied substantially both in wear resistance and in bending strength. As a result of these tests the author's company has developed a new classification for carbides, reduced the number of grades to be kept in stock and has prepared specifications for purchasing and selection of carbides. Tabulations of the test data and diagrams supplement the article.

Production Planning

A mathematical-graphical method for production planning has been developed by Ch. W. Fabry and is described in an article in *Werkstatt und Betrieb*, No. 6, 1954. To determine the number of operators required for a given job, he prepares a chart based on statistical observation of similar jobs and plots four curves. The first curve covers the production time per piece. It has a hyperbolic character due to the fact that the time per piece decreases as the number of produced pieces increases. A second curve indicates the time required per piece from the start of the process to finished product.

This latter time depends upon three other quantities, namely upon the time per piece, the number of operators per piece and the working time per man and day. This curve is similar to the first one mentioned with the exception that it reaches its minimum value at a number of pieces produced, which is only about 50 percent that of the first curve. The third curve takes the desired number of pieces into consideration; it is a straight line ascending at 45 degrees from left to right. Instead of plotting the number of pieces directly, the author has found it advantageous to plot the number of lots of the parts under consideration because in this way improvements in productive capacity can easily be found. The fourth curve refers to the daily working time per operator; it is usually a horizontal line parallel to the x-axis of the graph indicating 8 hours per man and day. Under certain conditions this line will have steps, indicating a deviation from the 8-hour schedule. Having plotted these curves against the number of pieces it is possible to find the answer to such questions as the number of operators required and others.

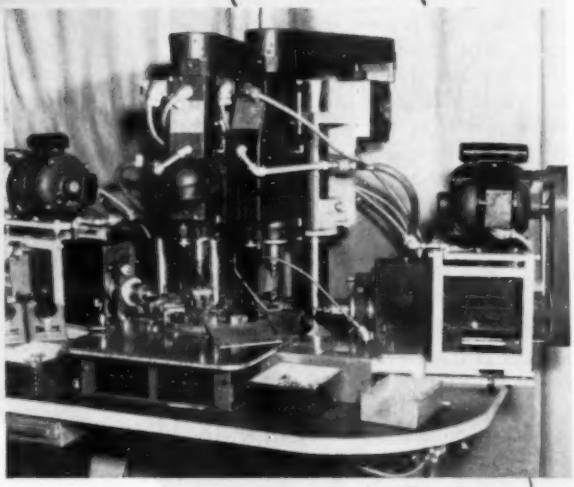
For further analysis the number of pieces are added and a composite curve is plotted on the graph from which it is easy to see whether the lot size should be changed according to the flow of the work through the shop. From this curve it is also possible to determine the number of operators and to avoid an oversupply in labor during the initial stages of production, which would have to be laid off later on as the production is running smoothly.

The author describes numerous other details which he can find from his mathematical-graphical methods such as the number of operators per lot, the scheduling of production, the total flow time and many other items.

A Birmingham Exchange and Engineering Center has been opened to serve world buyers as an information headquarters on British engineering industry.

If time meant money he'd drill and tap with

Bellows-LOCKE DRILL UNITS



An extra second or so drilling a hole may not mean much to a woodpecker. But in today's cost picture it means dollars to you.

If you have any part in which you are drilling or tapping two or more holes in any size up to 1/4" or 5/16", The Bellows-Locke Drill Unit offers practical opportunities for substantial cost reduction.

It is particularly effective as a basic component for toolroom-built special purpose drilling and tapping machines. It is compact, streamlined, relatively light in weight, can be installed in any angle in any plane. Any number of units can be easily synchronized and interlocked for accurately timed sequence operation.

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Major cost reductions are often the accumulated total of many minor savings. Look at your drilling and tapping costs with a critical eye.

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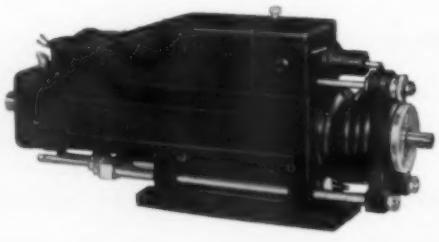

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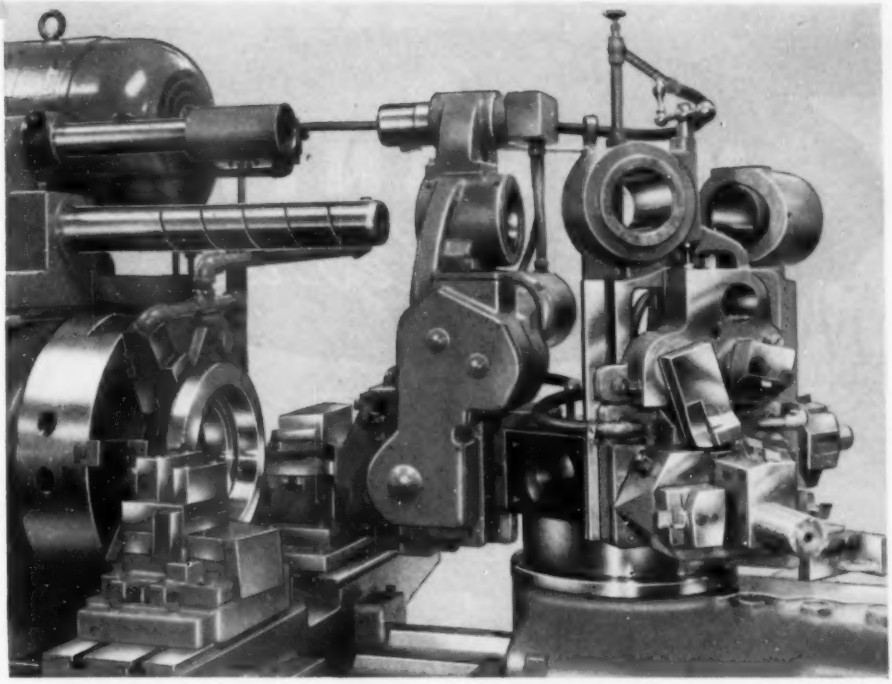
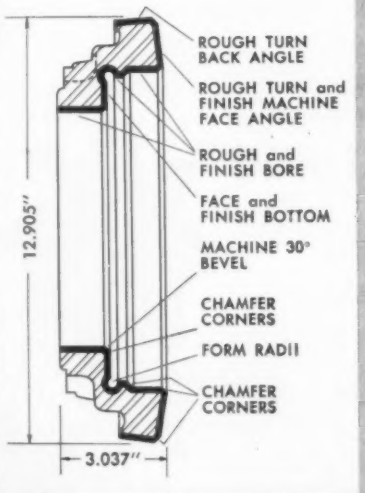


FORTY HORSES "pulled the team" that made this bevel gear blank



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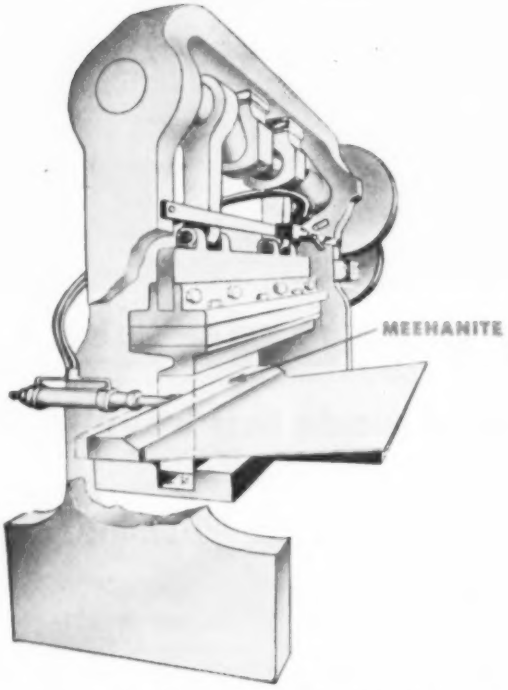
The MEEHANITE® Casting Reporter

ME ANI BACK GAG SAV $100 P R DA



In order to reduce production costs on a power bra the manufacturer devised an automatic flanging with a movable back gage which permitted the for ing of 6 different bends with a single set-up. Mater handling savings amounted to $100 per day.

Originally the back gage, key to the operation, w made of hardened and ground steel but wore rapi as a result of the horizontal thrust of the sharp ed of the steel sheet being worked.

The use of Meehanite metal for this gage solv the wear problem and three years after the insta tion the unit had gone through 9 million operati without removal for maintenance, repair, or straig ening.

The manufacturer states "The ability Meehanite metal to meet the service requirem permitted the successful design and operation the machine."

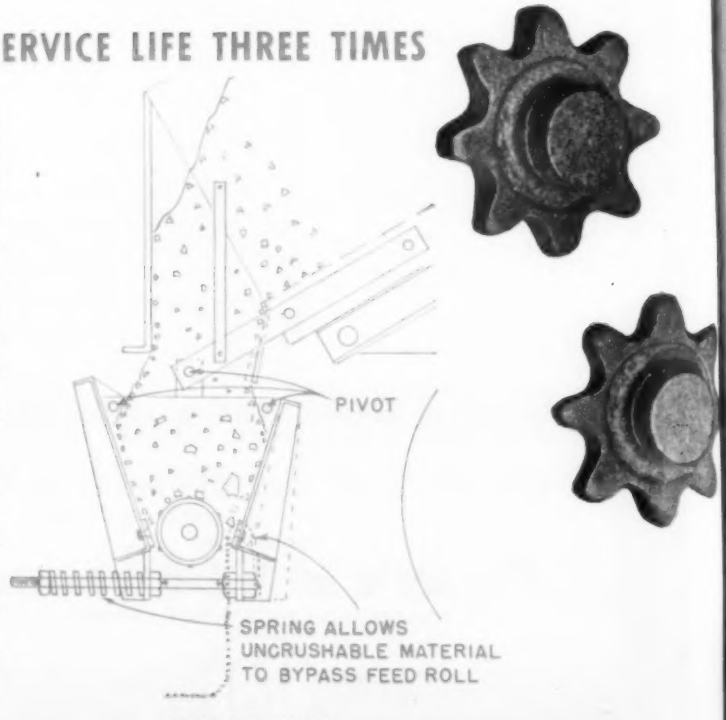
MEEHANITE SPROCKET INCREASES SERVICE LIFE THREE TIMES

In a sand and cinder spreader used for skid-proofing icy roads the operation of the material hopper is dependent upon a drive sprocket unit. The material being spread is fed between a feed roll and compression springs allow movement of the hopper sides in the event of hard, uncrushable pieces being passed.

The drive sprocket, when cast in high property bronze gave trouble through shearing at the clutch face when subjected to the high stresses created when hard and large lumps of material went through the hopper.

When produced as a Meehanite casting, the sprockets, after heat treatment, provided sufficient impact strength and abrasion resistance to eliminate breakage.

The manufacturer reports "that substantial cost savings have resulted and the operating life of the Meehanite sprocket is generally three times that of the previous material."



MEEHANITE CASTINGS HAVE DONE FOR THEM

HEAT TREATED MEEHANITE SCORING ROLLS REDUCE COST- IMPROVE WEARING QUALITIES

The ability to heat treat Meehanite castings and obtain increased hardness and greater wear resistance is revealed in the use of these castings for corrugated paper box scoring rolls.

The abrasive forces set up by corrugated paper are high and it is essential that the grooves and beads of the scores be machined to a high degree of accuracy. This, of course, is costly, and makes each days' service life important.

One large manufacturer of corrugated paper boxes declares: **"We use Meehanite rolls exclusively and find that the life of the units has been more than doubled since the specification of this material."**

ONLY A MEEHANITE FOUNDRY CAN MAKE MEEHANITE CASTINGS

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The American Laundry Machinery Co.	Rochester, New York
Atlas Foundry Co.	Detroit, Michigan
Banner Iron Works	St. Louis, Missouri
Barnett Foundry & Machine Co.	Irvington and Dover, New Jersey
E. W. Bliss Co.	Hastings, Mich. and Toledo, Ohio
Builders Iron Foundry	Providence, Rhode Island
Compton Foundry	Compton, Calif.
Continental Gin Co.	Birmingham, Alabama
Crawford & Doherty Foundry Co.	Portland, Oregon
The Cooper-Bessemer Corp.	Mt. Vernon, Ohio & Grove City, Pa.
DeLaval Steam Turbine Co.	Trenton, New Jersey
M. H. Detrick Co.	Newark, N. J. and Peoria, Ill.
Empire Pattern & Foundry Co.	Tulsa, Oklahoma
Farrel-Birmingham Co., Inc.	Ansonia, Connecticut
Florence Pipe Foundry & Machine Co.	Florence, New Jersey
Fulton Foundry & Machine Co., Inc.	Cleveland, Ohio
General Foundry & Manufacturing Co.	Flint, Michigan
Georgia Iron Works Co.	Augusta, Ga.
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MEEHANITE METAL CORPORATION
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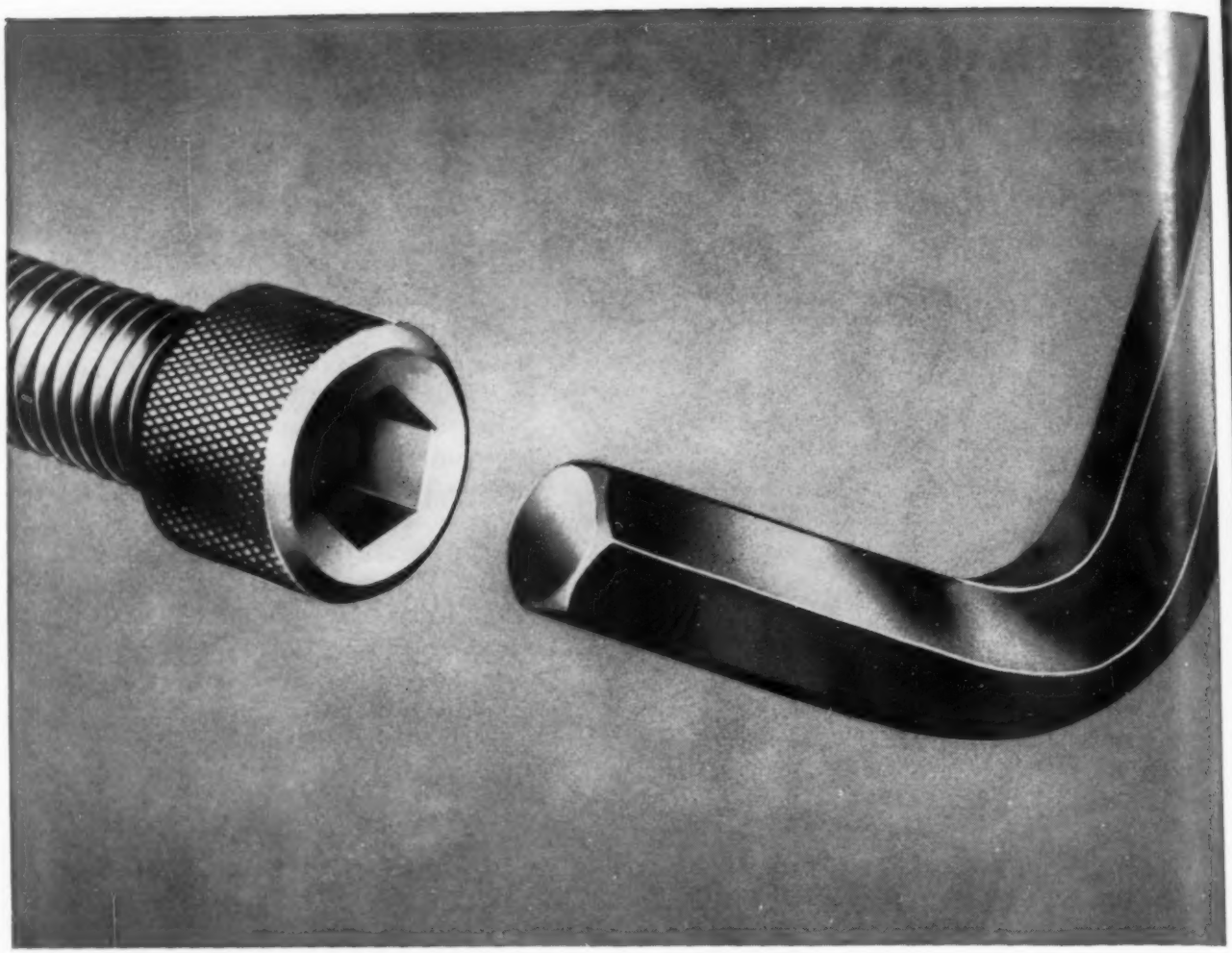

Bristol Hex Socket Cap Screws assure speedier, easier, tighter fastening

Bristol hex socket cap screws meet every production and maintenance requirement.

They spin easily into place, fit perfectly, and wrench up tightly, even in hard-to-get-at places. They take the wrench without skidding, too, so there's no danger of marring surfaces. Disassembly is just as easy. And Bristol's hex socket screws can be tightened far beyond the point where shock or vibration will loosen them.

This extra holding power results from the hex socket design, and Bristol's careful control over materials and manufacturing methods. Standard hex socket cap screws are made of alloy steel specially hardened. Other special metals and finishes may also be supplied. All Bristol screws are A.S.A. approved and precision threaded either National Coarse or National Fine.

Ask for Bristol hex socket cap or set screws in sizes from 0 wire to one inch in diameter at your industrial distributor's.

BRISTOL'S SOCKET SCREWS

THE BRISTOL COMPANY, Socket Screw Division, Waterbury 20, Conn.

Fifty Years
1904 • 1954

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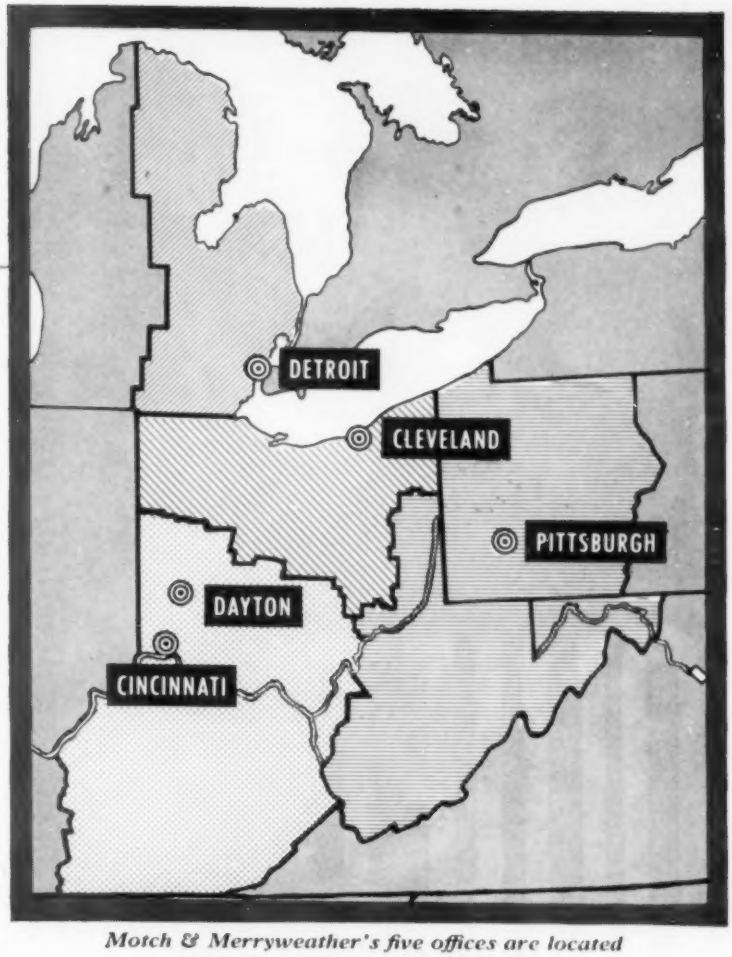
an organization which has served the metal-working industry since 1904.

FIFTY YEARS ago in September, this company was founded as a distributor of machine tools in Ohio and eastern Michigan. Now in the second generation, its operations have broadened to provide a complete machine tool and cutting tool service:



Motch & Merryweather's five offices are located in the heart of industrial America.

- **AS *DISTRIBUTORS* OF MACHINE TOOLS AND CUTTING TOOLS:**
  Machine Tool Distributor Division
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  } *in area shown on map.*
- **AS *MANUFACTURERS* OF MACHINE TOOLS AND CUTTING TOOLS:**
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  } *represented nationally by distributors.*
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The last fifty years have seen phenomenal progress in America and throughout the world. In those advances the machine tool industry has played a foremost role. Whatever contribution Motch & Merryweather has been privileged to make can only be an incentive toward continued effort in the same direction during the half century ahead. . . May we serve you?

MOTCH AND MERRYWEATHER MACHINERY CO.
CLEVELAND DETROIT
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OUR NAME PLATE—
symbol of quality for 50 years.

THE MOTCH & MERRYWEATHER MACHINERY CO.

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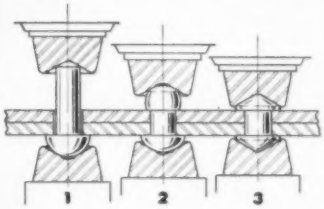
QUIET *riveters at work*

. . . not a sound as ⅜" rivets are cold formed in 2½ seconds . . . each the exact counterpart of its neighbor. The power source, a complete, self-contained, compact hydraulic pressure generator. The tool, unique and easily handled, is controlled by the touch of a button—fast, smooth, precise, automatic AND SILENT! Hannifin "Hy-Power" portable or stationary units are available in capacities from 5 tons to 100 tons (more in multiple) for riveting, punching, pressing, assembly or shearing.

Hannifin hydraulic and pneumatic machines can profitably serve you in many ways . . . consult our engineers on the possibilities. Hannifin Corporation, 519 Wolf Road, Des Plaines, Illinois.

The quiet "Hy-Power" Hydraulic Work Cycle



Hydraulic pressure, under instant, reversible, finger-tip control, silently squeezes rivets in this manner:

1. Fast approach (completed)
2. Rivet being squeezed
3. Rivet formed; ram returns

"Hy-Power" Hydraulics should be in your design file. Ask for Bulletin 150. Your copy will be supplied promptly.

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• **MIKRON No. 79** is an excellent choice for small spur gears and pinions. It is simple to operate, to set-up and to change-over from job to job. CAPACITY: Gears, max. dia. 1 9/16"; max. length of cut 1 1/8"; number of teeth 6 to 390; pitch DP 26 and finer.

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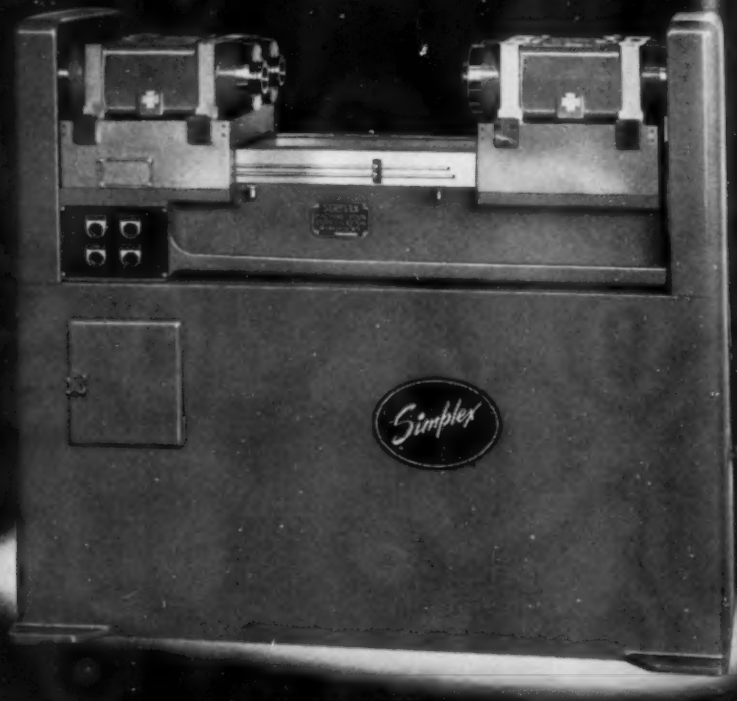
Simplex

PRECISION BORING MACHINES

SPECIFICATIONS

Table Travel	15"
Table Width	13"
Size Heads	#2 or #3
Standard Feeds	1" to 9"/min.
Special Feeds	2" to 18"/min.



Model #2BDA

Model #2BA

The new SIMPLEX 2BA and 2BDA Precision Boring Machines are offered at a price that will prove attractive to any shop. These machines provide for a complete automatic cycle at a low cost and can be operated by inexperienced help. The automatic cycle consists of rapid traverse, feed, dwell, and rapid return. After the start button is initially pressed, the above mentioned cycle is controlled by the position of trip bars which actuate limit switches. Feed rate changes can be accomplished during setup through use of feed change gears.

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SPECIAL DRILLING, TAPPING AND BORING MACHINES

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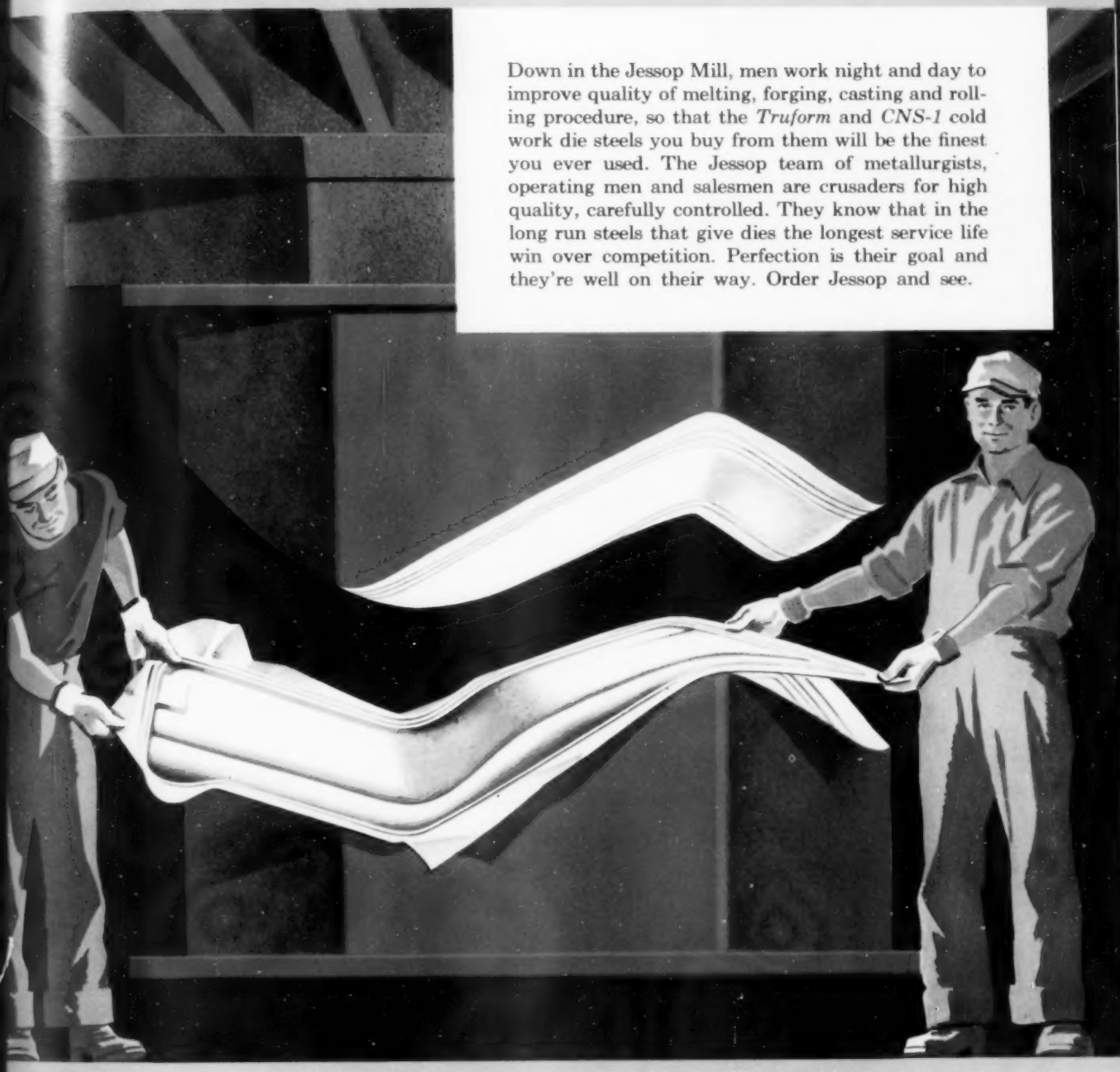

Down in the Jessop Mill, men work night and day to improve quality of melting, forging, casting and rolling procedure, so that the *Truform* and *CNS-1* cold work die steels you buy from them will be the finest you ever used. The Jessop team of metallurgists, operating men and salesmen are crusaders for high quality, carefully controlled. They know that in the long run steels that give dies the longest service life win over competition. Perfection is their goal and they're well on their way. Order Jessop and see.

STAINLESS STEELS • HIGH SPEED STEELS • NON-MAGNETIC STEELS • HIGH SPEED TOOL BITS • HEAT RESISTING STEELS • STAINLESS-CLAD PLATES • CARBON AND ALLOY STEELS • TOOL STEELS FOR SPECIAL PURPOSES • CAST-TO-SHAPE TOOL STEELS • HIGH SPEED AND ALLOY SAW STEELS • TEMPERED AND GROUND STRIP STEEL • COMPOSITE HIGH SPEED STEELS • STAINLESS AND HEAT RESISTING CASTINGS • COMPOSITE DIE STEEL SECTIONS • PRECISION GROUND FLAT STOCK • DIE STEELS—HOT AND COLD WORK

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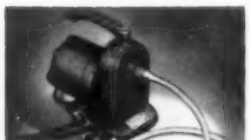
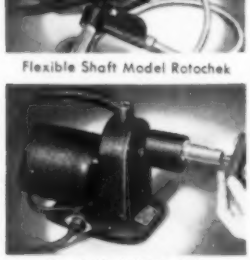
Taft-Peirce Rotochek Gages Threads 3 Times Faster



Flexible Shaft Model Rotochek



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You can triple your thread inspection rate with this simple, inexpensive device. A Rotochek is fast . . . accurate . . . easy to use. Operators report from 3 to 4 times as many parts inspected daily.

Simply push-pull and the part is inspected. Bring the part to the Rotochek, or the Rotochek to the part — a slight push and gage screws into the work. Release the pressure and the gage stops. Pull — and it disengages.

Available in bench model, or with gaging head on flexible shaft. Adaptors permit use of reversible thread members and ring gages. Send for bulletin with full description and prices.

Gage Blocks Plain Gages Thread Gages Rotochek

T-P means Top Precision

T P

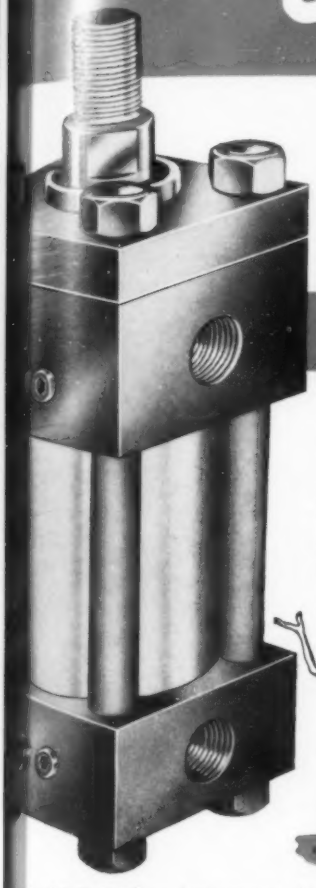
THE TAFT-PEIRCE MANUFACTURING COMPANY, WOONSOCKET, R. I.

...ighlighting Miller's Quality-Famous Line of "Custom-Built" Cylinders...

Stock AIR AND HYDRAULIC CYLINDERS

Available for *Immediate Delivery*...

in the popular sizes, mountings and prices listed below



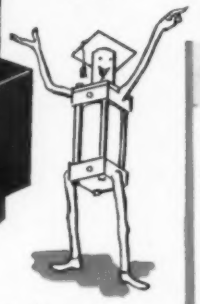
Any of the *Interchangeable* "Stock" Mountings illustrated are attached by our factory to the "in-stock" Basic Model 53 with the tie rod nuts in a few moments. This gives you a selection of over 500 different "Stock" Cylinders for *immediate use*—and permits easy conversion to other models for *future re-use*. Thus, you save delivery and production time, investment cost and storage space.

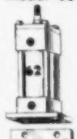
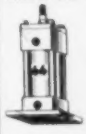
PRICES OF MILLER "STOCK" CYLINDERS WITH MOUNTINGS ATTACHED AS ILLUSTRATED

(Prices on the separate mounting attachments for future re-use are available on request)

ORDER DIRECTLY FROM THIS LIST . . .

Shipment can be generally made within 24 hours after we receive your order. Prices are F. O. B. our plant.



			Basic Model 53		Model 77	Model 61	Model 62	Model 65	Model 66	Model 86
										
			Tie Rod Mounting		Foot Mounting	Rod End Flange	Cap End Flange	Rod End Flange	Cap End Flange	Pivot Mounting
Bore	Stroke	Cushion	AIR A53	HYD. H53	AIR A61 A77	HYD. H61 H77	AIR A62	HYD. H62 H65	AIR A66	HYD. H66 H86
1½"	2"	Non		$ 58.50		$ 61.40		$ 66.70		$ 72.85
1½"	4"	Non		60.70		63.60		68.90		75.05
1½"	6"	Non		62.90		65.80		71.10		77.25
1½"	8"	Non		65.10		68.00		73.30		79.45
1½"	11"	Non		68.40		71.30		76.60		82.75
2"	2"	Non	$ 37.70		$ 39.75		$ 42.30		$ 44.60	
2"	4"	Non	39.40		41.45		44.00		46.30	
2"	6"	Non	41.10		43.15		45.70		48.00	
2"	8"	Non	42.80		44.85		47.40		49.70	
2"	11"	Non	45.35		47.40		49.95		52.25	
2"	3"	Both	62.05	94.50	64.10	97.45	66.65	103.05	68.95	111.55
2"	5"	Both	63.75	97.00	65.80	99.95	68.35	105.55	70.65	114.05
2"	7"	Both	65.45	99.50	67.50	102.45	70.05	108.05	72.35	116.55
2"	9"	Both	67.15	102.00	69.20	104.95	71.75	110.55	74.05	119.05
2"	13"	Both	70.55	107.00	72.60	109.95	75.15	115.55	77.45	124.05
2½"	2"	Non	41.45	73.30	43.70	76.25	46.25	82.30	49.00	93.10
2½"	4"	Non	43.35	76.00	45.60	78.95	48.15	85.00	50.90	95.80
2½"	6"	Non	45.25	78.70	47.50	81.65	50.05	87.70	52.80	98.50
2½"	8"	Non	47.15	81.40	49.40	84.35	51.95	90.40	54.70	101.20
2½"	11"	Non	50.00	85.45	52.25	88.40	54.80	94.45	57.55	105.25
3¼"	3"	Both	77.80	126.85	80.35	131.20	84.15	138.60	87.70	149.95
3¼"	5"	Both	79.80	129.85	82.35	134.20	86.15	141.60	89.70	152.95
3¼"	7"	Both	81.80	132.85	84.35	137.20	88.15	144.60	91.70	155.95
3¼"	9"	Both	83.80	135.85	86.35	140.20	90.15	147.60	93.70	158.95
3¼"	13"	Both	87.80	141.85	90.35	146.20	94.15	153.60	97.70	164.95
4"	2"	Non	56.25	106.00	59.10	111.15	62.95	118.90	67.30	132.80
4"	4"	Non	58.85	109.40	61.70	114.55	65.55	122.30	69.90	136.20
4"	6"	Non	61.45	112.80	64.30	117.95	68.15	125.70	72.50	139.60
4"	8"	Non	64.05	116.20	66.90	121.35	70.75	129.10	75.10	143.00
4"	11"	Non	67.95	121.30	70.80	126.45	74.65	134.20	79.00	148.10
5"	3"	Both	98.25		101.40		105.25		110.60	
5"	5"	Both	101.65		104.80		108.65		114.00	
5"	7"	Both	105.05		108.20		112.05		117.40	
5"	9"	Both	108.45		111.60		115.45		120.80	
5"	13"	Both	115.25		118.40		122.25		127.60	
6"	2"	Non	80.60		83.95		87.85		94.15	
6"	4"	Non	84.90		88.25		92.15		98.45	
6"	6"	Non	89.20		92.55		96.45		102.75	
6"	8"	Non	93.50		96.85		100.75		107.05	
6"	11"	Non	99.95		103.30		107.20		113.50	
8"	3"	Both	157.35		161.05		167.90		174.95	
8"	5"	Both	162.45		166.15		173.00		180.05	
8"	7"	Both	167.55		171.25		178.10		185.15	
8"	9"	Both	172.65		176.35		183.20		190.25	
8"	13"	Both	182.85		186.55		193.40		200.45	

"Stock" Cylinders fully meet the J.I.C. ...rds and are identical to Miller "Custom-...Cylinders in design and construction.

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...mplete descriptive and dimensional ...both "Stock" and "Custom-Built" Miller ...rs, write for Bulletins A-105 and H-104 ...EE on request.

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"Stock" Boosters, Too! Immediate delivery on Miller Dual Pressure Boosters; 5" bore, 1" ram (80 psi air input produces 2000 psi hydraulic output for driving one or more work cylinders simultaneously). In 6" and 12" strokes. Write for data and price

...ete Miller "custom-built" line includes: air cylinders, 1½" to ...res, 200 psi operation; low pressure hydraulic cylinders, ...6" bores for 500 psi operation, 8" to 14" bores for 250 psi ...ion; high pressure hydraulic cylinders, 1½" to 12" bores, ...3000 psi operation. All mounting styles available. Also, a ...e line of Fluid Pressure Boosters and Accumulators.

MILLER FLUID POWER CO.

(Formerly MILLER MOTOR COMPANY)

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AIR & HYDRAULIC CYLINDERS • BOOSTERS • ACCUMULATORS

COUNTERBALANCE CYLINDERS

Try SANDVIK *Coromant*

CARBIDE TOOLS DESIGNED FOR LONGER-LASTING TOOL "BITE"

From ore to finished product within the same company

Coromant's quality and high wear-resistance means lower maintenance cost—higher production per tool.

The reasons for SANDVIK COROMANT'S success are:

1 **EXTENSIVE RESEARCH COMBINED WITH ENGINEERING SKILL**
Sandvik's modern metallurgical laboratories have developed carbides extremely well suited in hardness, wear and cratering resistance and strength for every type of material.

2 **BASIC PURITY OF RAW MATERIAL**
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3 **UNIFIED CONTROL BY SANDVIK FROM ORE TO FINISHED PRODUCT**
From the tungsten mine through each production stage, Sandvik maintains close control and careful inspection.

4 **HIGH QUALITY, SHOCK AND VIBRATION RESISTANT STEEL SHANKS**

5 **UNIQUE BRAZING METHOD WITH HIGH MELTING POINT BRAZING**

6 **COMPETENT ENGINEERING SERVICE**
Thousands of work files are at your disposal along with well trained field engineers to help to solve your machining problems.

Coromant is available:

- **In a wide variety of tools and blanks from stock—including many shapes and designs which have been considered "specials" before.**
- **In all standard grades with improved performance to suit a wide range of applications.**
- **Grades permanently color-identified on the end of tool shank and etched in the carbide blanks.**
- **In the new, time saving "Coromant Combination Cutter."**

Why not try Coromant's long-lived "bite" on your application. Contact Sandvik for further information.

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THE MODERN TYPE M STUD SETTER*

A Better Stud Setter for Better Stud Setting!

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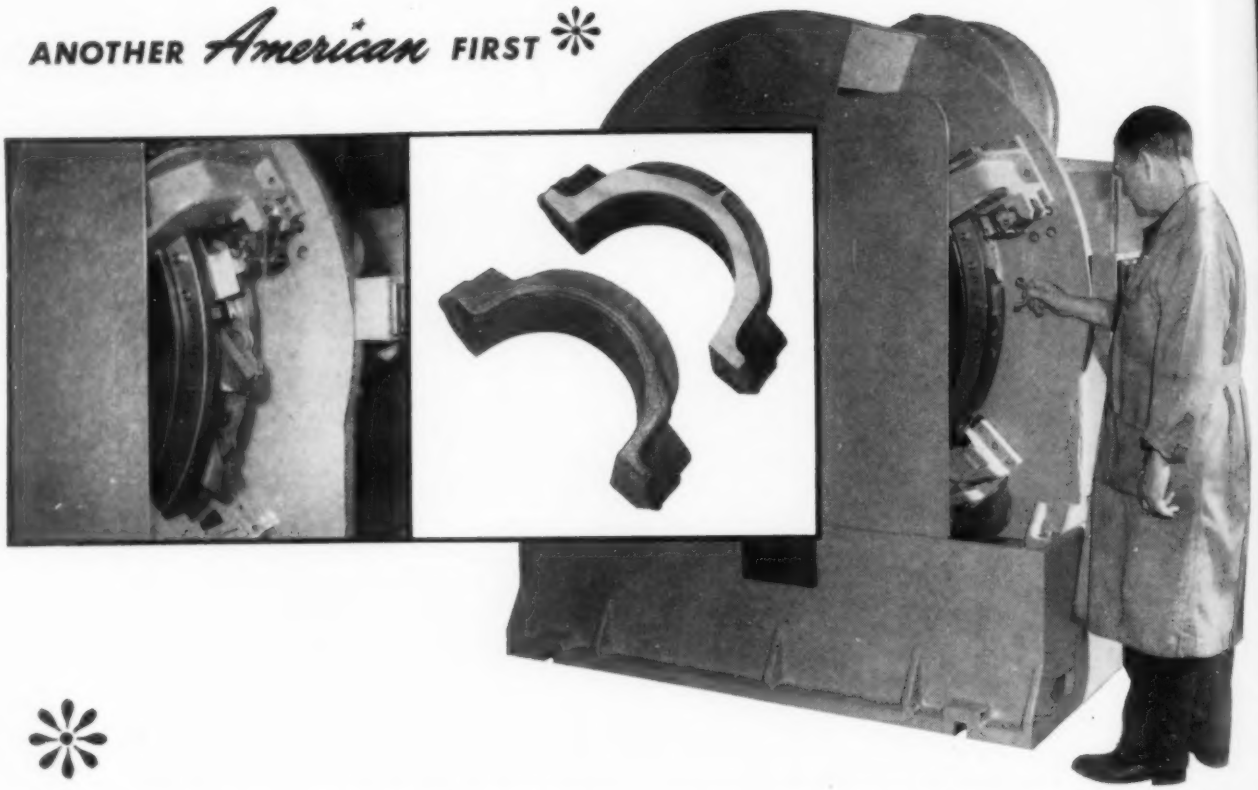


STRADDLE BROACHING ON ROTARY MACHINE MEETS HIGH-SPEED PRODUCTION DEMANDS

1000 connecting rod caps broached per hour —

Continuous, automatic broaching is a necessity on some high production jobs. When required and the nature of the work permits, American engineers develop special, revolutionary machines to solve bottlenecks and reduce metal removal costs to the lowest possible point.

A typical example is this special 36" Rotary Continuous Surface Broaching Machine. It is designed to straddle broach two sides of a connecting rod cap. The production cycle is continuous. The operator manually loads parts into the holding fixture. As the part moves into broaching position it is automatically clamped, broached, unclamped, and ejected into the chute at the bottom of the machine. Operating at 75% efficiency, this American machine is capable of producing 1000 parts per hour. The connecting rod cap is a steel forging.

For practical, high production, low cost solutions to your metal cutting problems see American first. A sample part or detail drawing and mention of your production requirements will receive prompt attention from American.

Write today for American Circular 300 which gives you data on standard American Vertical Hydraulic Surface Broaching Machines.

AMERICAN *American* BROACH & MACHINE CO.
A DIVISION OF SUNDSTRAND MACHINE TOOL CO.
ANN ARBOR, MICHIGAN

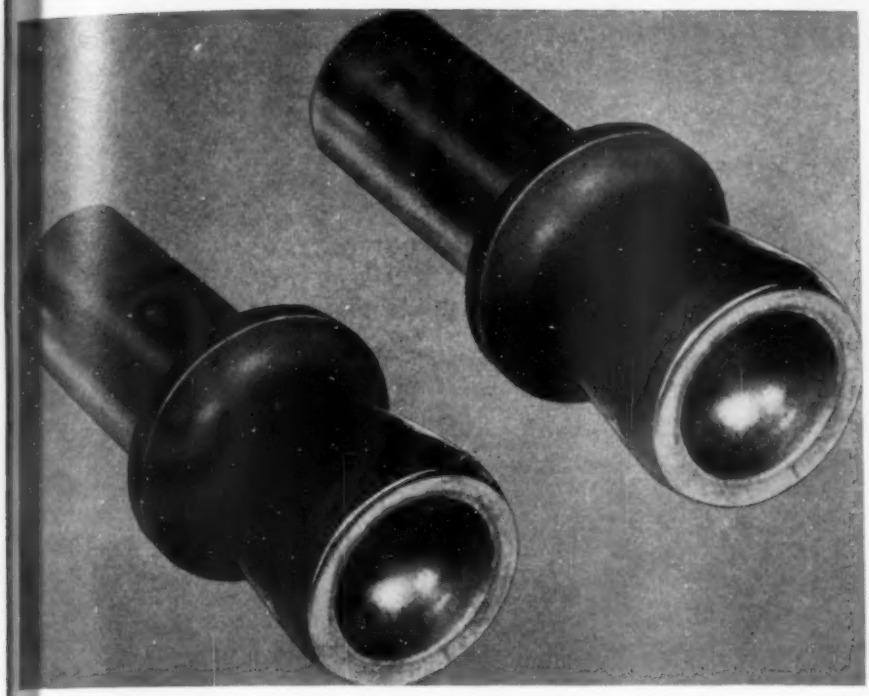
SUNDSTRAND

See *American* First — for the Best in Broaching Tools, Broaching Machines, Special Machinery

Tool Steel Topics

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation



Boiler Shop Using Bearcat Rivet-Sets Ups Average Run from 300 to 2470

The mechanical department of a large boiler shop had trouble driving more than 300 hot rivets, using standard rivet-sets. Once that mark had been reached, the sets would crack or spall. Sometimes recupping saved the day, but oftener than not the sets had to be replaced.

We were sure they could get longer runs with rivet-sets of Bearcat tool steel. The management gave Bearcat a trial, and put six sets to work after a heat-treatment cycle consisting of preheating at 1200F, air-quenching at 1750, and tempering at 550.

The results were even better than expected. The average run increased from 300 to 2470 before recupping was required. Not only that, but the recupping was accomplished without heat-treatment, which of course is a frequent source of trouble with rivet-sets of carbon tool steel.

Bearcat is an ideal tool steel for the manufacture of rivet-sets because of its superior shock-resistance. It is also well suited for uses where hot-work properties and easy machining are essential.

BEARCAT'S BIG FEATURES

1. Super shock-resistance
2. Deep-hardening . . . in air
3. Machines easily (Brinell 197 max)
4. Low distortion in heat-treatment
5. Good hot-work properties
6. Easily carburized for long wear

Typical Analysis

C	Mn	Si	Cr	Mo
0.50	0.70	0.25	3.25	1.40

In addition to being used for rivet-sets, Bearcat is ideal for such hot- and cold-shock applications as chisels, punches, hot headers and gripper dies. It has many other uses, too — master hobs, engraving dies, die-casting dies, and short-run dies used in cold-forming, blanking and bending.

You'll be well pleased with the service life obtained with Bearcat. We stock Bearcat in our mill depot. Or you can obtain a supply through your local Bethlehem tool steel distributor.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

Use Care When Hardening Hot-Work Tools

Although hot-work tools can be hardened to Rockwell C-56-60, there are hardly any applications where such hardness is beneficial. The majority of hot-work tools are used in a hardness range of C-41-44, or C-46-49. On new hot-work applications, a common mistake is to heat-treat to a hardness level which is too high for the application, with the result that rapid heat checking or breakage occurs.

For example, put tools of our Hot Work 8 analysis to work at C-55 or higher, and chances are, they will fail prematurely. Yet these same tools, used at Rockwell C-52 or lower, will give outstanding service.

On every hot-work application the best hardness level must be determined by experience. There's always a compromise involved, as the highest hardness is best for wear-resistance, and the lowest hardness is more resistant to heat-checks. Our suggestion? To be sure of maximum service, don't overharden hot-work tools.

IT'S A-H5 FOR LONG PRODUCTION RUNS

This high-production die, made of A-H5, blanks and punches sheet steel of 0.180-in. thickness. A-H5 makes possible long production runs between grinds. It holds a durable cutting edge, and resists distortion in heat-treatment.

. . . Save 14%

Example: Basic† price of a premium-price "White" wheel 7" x 1/2" x 1 1/4" is $4.78.

Basic price of a BAY STATE 8A wheel of the same size is only $4.10.

SAVING IS $.68 ON A SINGLE WHEEL . . . or 14%!

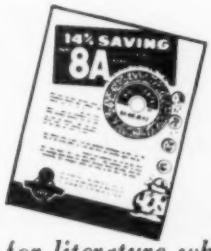
What's more . . . these 8A wheels give you fast, free, cool cutting-action, plus minimum dressing and long life. This means MAXIMUM ECONOMY for your tool grinding operations . . . with "8A", those important first two symbols in the wheel specification.

Another part of this specification is important too! It's the "V2" symbol at the end, that means these economical wheels are available in BAY STATE'S EXCLUSIVE FRACTIONAL GRADES (Three separate degrees of hardness within a single normal grade). This lets you select exact wheels for each requirement.

These and many other BAY STATE innovations are the reasons for BAY STATE'S rapid rise to its position as a foremost supplier of quality abrasive products to American industry.

†*Basic prices are subject to discount.*

BAY STATE ®
WHEELS of PROGRESS



Send for literature which includes listing of stock wheels with proven specifications.

Manufacturers of all types of Quality Abrasive Products

BAY STATE ABRASIVE PRODUCTS CO., Westboro, Mass., U. S. A.

Branch Offices and Warehouses — Chicago, Cleveland, Detroit, Pittsburgh
Distributors — All principal cities
In Canada: Bay State Abrasive Products Co. (Canada) Ltd., Brantford, Ont.

KELLER TOOLS "button up"

461 assemblies an hour all day long!

Two workers make a team in assembling parts for automobile horns. Above, the screws are started which attach assemblies of stacked parts to the horn yoke. At left, the two screws are run down and tightened. Both workers use Keller Pneumatic Screw Drivers, and together they assemble at the rate of 461 units per hour.

Sustained high production rates result from providing workers with easy-to-handle Keller Air Tools engineered to the job. Waste motions are eliminated, fatigue is reduced, and production speeds are maintained hour after hour.

Keller application engineers, located in principal cities from coast to coast, have the training, know-how, and experience to select the correct tool for the job. They have a much wider selection of attachments, fittings, pickups, and finders from which to choose... plus the backing of design engineers ready and able to provide special adaptations or special tools if needed.

Have you talked to the Keller man, lately?

These are a few of the many Keller Screw Drivers:

KELLER

Pneumatic Tools

KELLER TOOL CO.

1311 Fulton Street
Grand Haven, Michigan

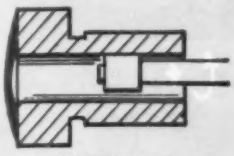
New TRIPLE C* GRINDING COOLANT

by MOTCH & MERRYWEATHER

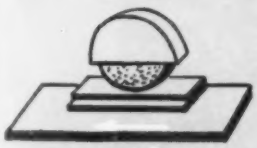
clear
cool
clean

for results you can see . . .

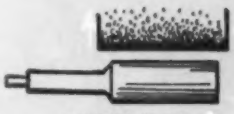
TRIPLE C FOR ALL WET GRINDING



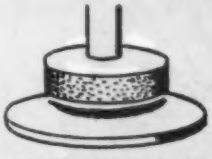
INTERNAL



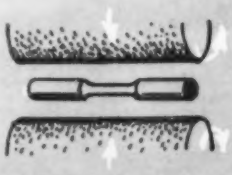
FLAT RECIPROCATING



EXTERNAL



FLAT ROTATING



CENTERLESS

Motch & Merryweather now offers Triple C Grinding Coolant to the metal-working industry. Triple C has been thoroughly tested and widely used with great success. Proven advantages:

CLEAR—transparent solutions—you can see the progress of your work. COOL—dissipates heat; maximum cooling maintained. CLEAN—flushes chips quickly; wheels stay clean and free-cutting. Filters remain clean and free-acting. There is no disposal problem. Grinding dust settles rapidly. Triple C does not foam or produce a foul odor, even on cast iron. Solutions remain stable. Desirable properties are maintained, even in the hardest water. Descriptive bulletin upon letterhead request.

Fifty Years 1904 - 1954

Triple C comes in 9-lb. and 50-lb. metal containers and in 150-lb. steel drums. Order a supply today from your local M. & M. dealer.

THE MOTCH & MERRYWEATHER MACHINERY CO.

CUTTING TOOL MANUFACTURING DIVISION

CLEVELAND 17, OHIO

*TRADE MARK

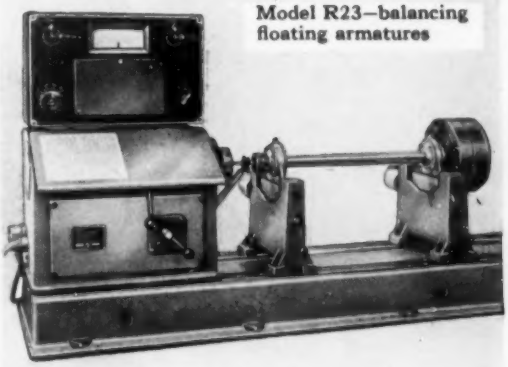
PRODUCTION . . . BALANCING

WITH

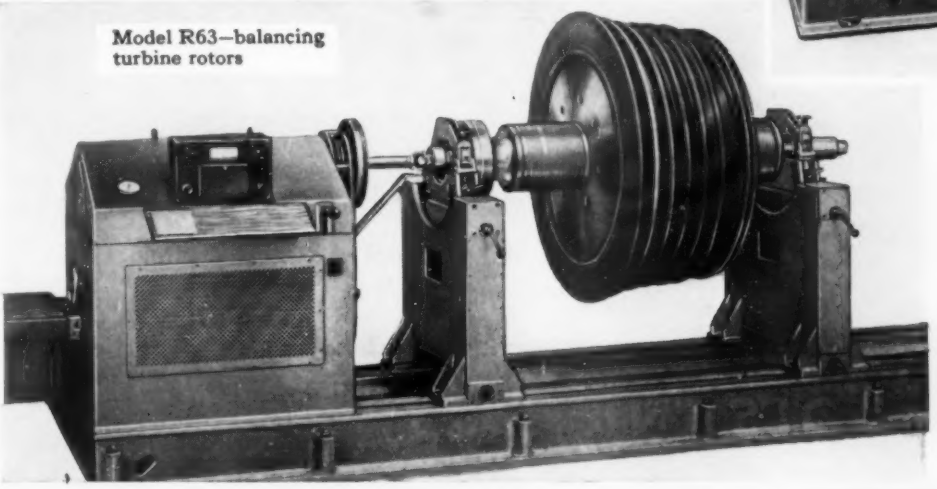
SCHENCK

ELECTRO-DYNAMIC BALANCING MACHINES

Now, in a fraction of a minute and in a single run, you can accurately determine the amount and location of dynamic and static unbalance on rotating parts. The SCHENCK Electro-Dynamic Balancing Machine has a sensitive and accurate electrical measuring system—without electronic tubes or oscillograph—that will indicate unbalances deviating as little as 0.00004" from the center of gravity. Simple and easy to operate, the SCHENCK Balancer, by coordinate measurement, quickly indicates on a Wattmeter the unbalance of the rotating part.



Model R23—balancing floating armatures



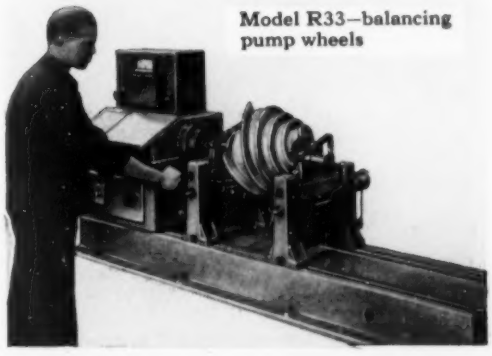
Model R63—balancing turbine rotors

The workpiece is balanced easily by adding or removing weight units at two of the four balancing points located within the coordinates, 90 degrees apart. For many production installations, Schenck Balancers combined with machine tools—check, correct and inspect parts in one set-up.

SCHENCK ELECTO-DYNAMIC BALANCING MACHINES ARE THE RESULT OF 40 YEARS WORLD-WIDE EXPERIENCE. THEY ARE MADE IN MANY CAPACITIES TO BALANCE ROTATING PARTS WEIGHING UP TO 100 TONS.

Machine Type	R13	R23	R33	R43	R53
Measuring Range (Weight of part in lbs.)	.1-22	.3-66	1-220	3-660	11-2,200
Machine Type	R63	R73	R83	R93	
Measuring Range (Weight of part in lbs.)	33-6,600	110-22,000	330-66,000	1100-220,000	

Let Cosa Engineers recommend the proper Schenck Balancer for your needs. Or, send for detailed catalog.

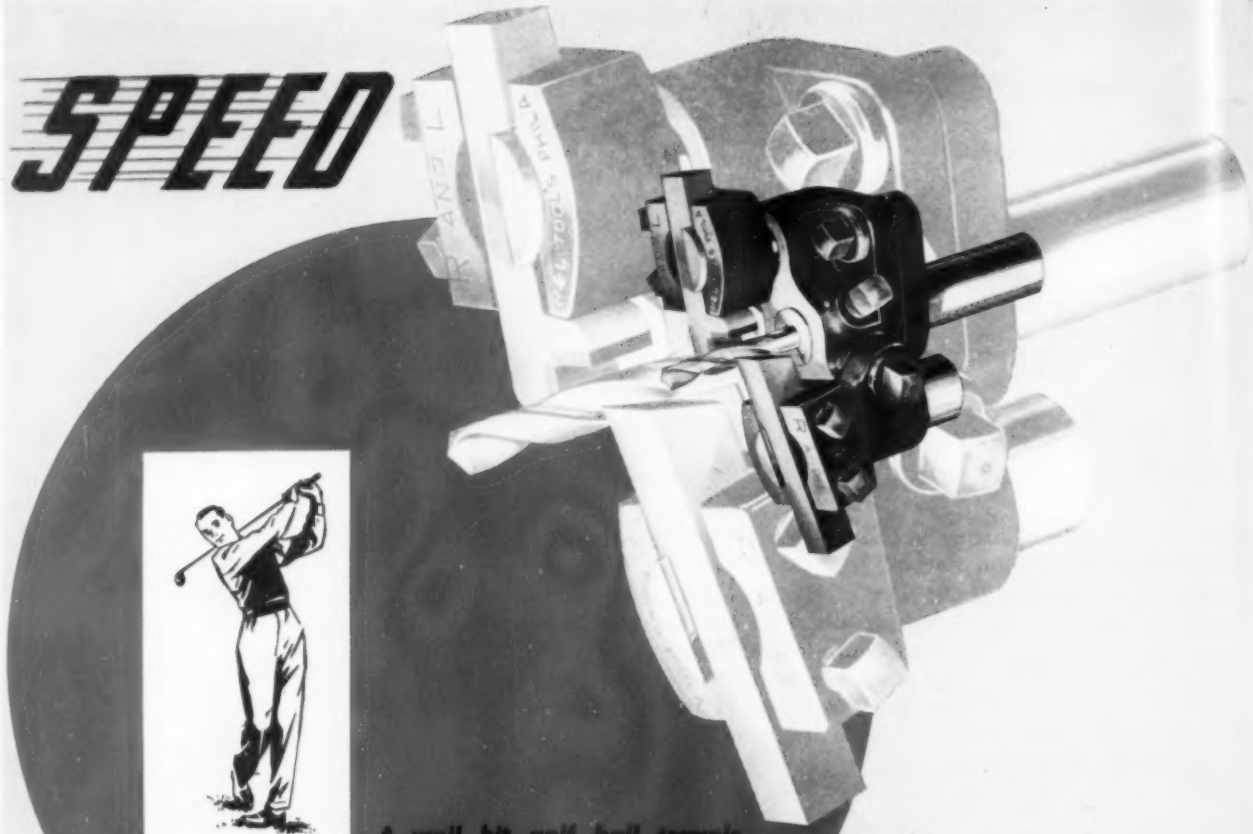


Model R33—balancing pump wheels

COSA — *nationwide sales and service of precision machine tools —from bench lathes to boring mills.*

COSA CORPORATION, 405 LEXINGTON AVENUE, NEW YORK 17, N. Y.

SPEED



A well hit golf ball travels fast — 135 m.p.h.! The R and L TURNING TOOL is fast too — can be changed from right to left in 10 seconds.

14 TOOLS IN ONE

Does the job of fourteen tools . . . it's the only tool of its kind on the market. Drilling and turning; turning; centering and burnishing; pointing and form turning; drilling and chamfering; pointing . . . The R and L TURNING TOOL performs all these jobs. It is constructed of tough, heat-treated alloy steel . . . guaranteed not to bend or give way.

Write for Catalog

RIGHT R and L LEFT TOOLS

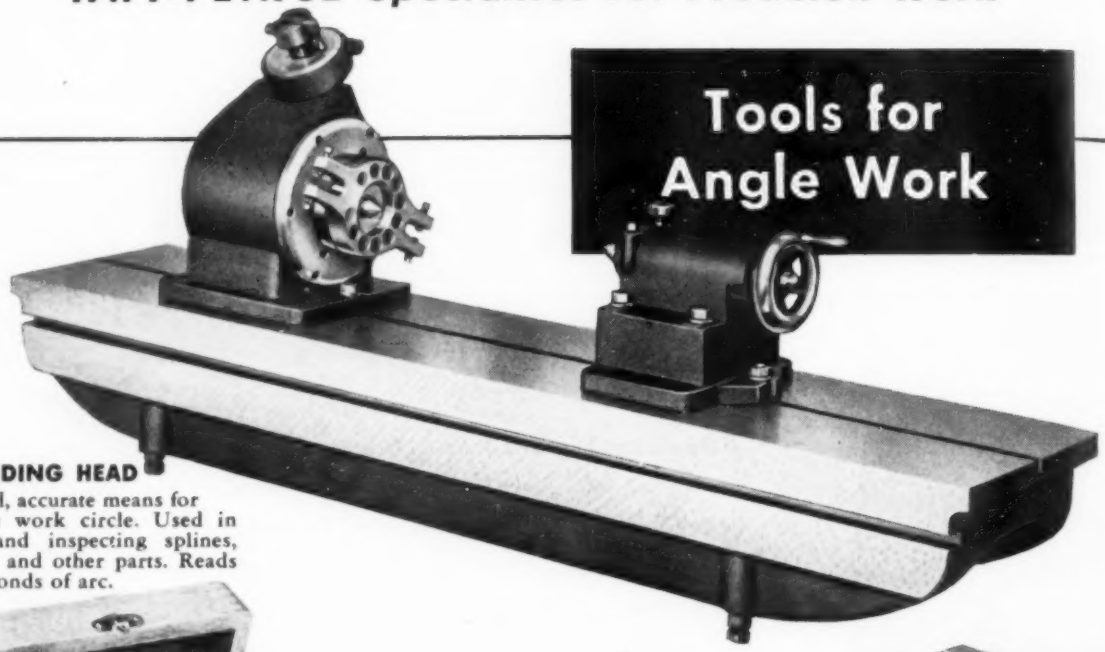
1825 BRISTOL STREET • PHILADELPHIA 40, PA.

TURNING TOOL • CARBIDE OR ROLLER BACKRESTS • RELEASING OR NON-RELEASING TAP AND DIE HOLDERS, (ALSO AVAILABLE FOR ACORN DIES) • UNIVERSAL TOOL POST • TURRET BACKREST HOLDER • CUT-OFF BLADE HOLDER • RECESSING TOOL • REVOLVING STOCK STOP • FLOATING DRILL HOLDER • KNURLING TOOL

Increase Production Range and Capacity

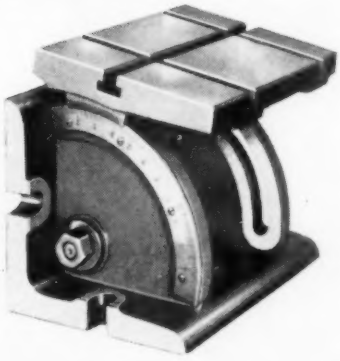
with these

TAFT-PEIRCE Specialties for Precision Work



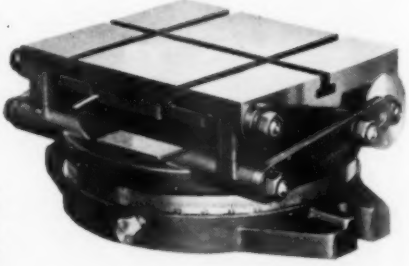
T-P DIVIDING HEAD
offers a rapid, accurate means for dividing the work circle. Used in measuring and inspecting splines, gears, cams, and other parts. Reads within 6 seconds of arc.

T-P SINE BARS & SINE BLOCKS
First conceived and built by Taft-Peirce, they locate work to any given angle within very close limits. Tapped holes permit clamping.



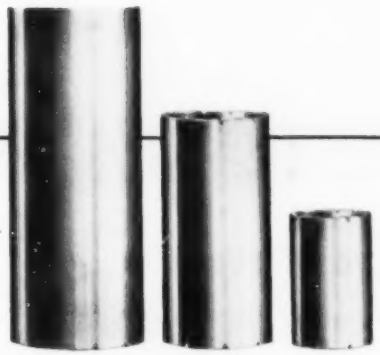
T-P TOOLMAKER'S ADJUSTABLE KNEE
simplify inspection or setup of angular work. Graduated quadrant and vernier reads to 5 minutes of angle.

T-P ANGLE BLOCKS
speed setup and grinding of small angular work on a magnetic chuck. Can be used individually or in any combination to form V-blocks.

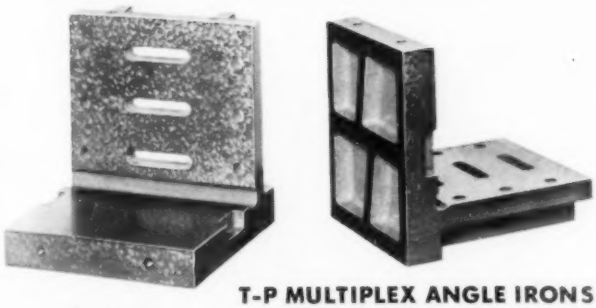


T-P ADJUSTABLE ANGLE PLATE
tilts and turns. Makes compound angles easy to setup for machining. Both tilting table and rotating base are graduated from 0 to 90 degrees in each direction.

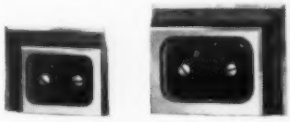
Reference Surface Tools



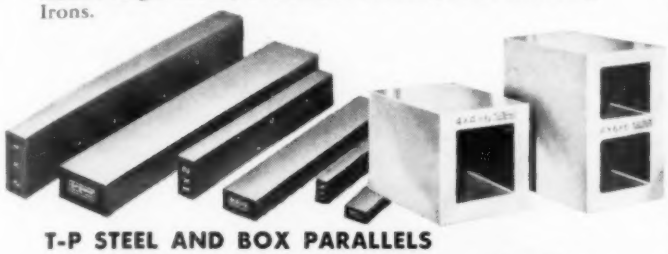
T-P CYLINDRICAL SQUARES
Used with T-P Surface Plate they provide a convenient, accurate reference line for any vertical work-surface.



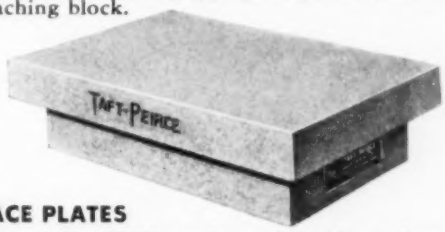
T-P MULTIPLEX ANGLE IRONS
All surfaces are scraped accurately flat for faster, easier setups. Other types available include Duplex Angle Irons, Slotted Angle Irons, Toolmaker's Knees, and Measuring Irons.



T-P UNIVERSAL SQUARES
High precision squares that can be used in any position. Hard rubber center facilitates gripping . . . prevents hand heat from reaching block.

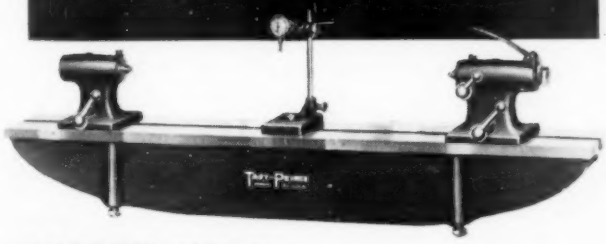


T-P STEEL AND BOX PARALLELS
are available in a complete line of stock sizes. Also, Planer and Boring Machine Parallels, Levelling Straight Edges, and Steel Straight Edges.

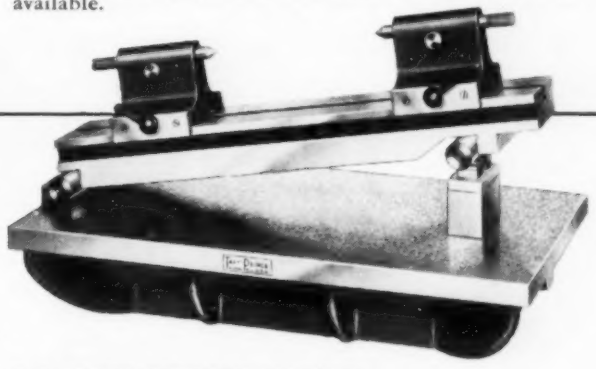


T-P SURFACE PLATES
Extremely fine grain of T-P granite surface plates gives smoother more wear-resistant surface, assures top precision over longer periods. Cast Iron surface plates also available.

Versatile Inspection Tools



T-P BENCH CENTERS
simplify inspection work. Have unusual rigidity and permanent accuracy. This is typical of a wide range of inspection tools available at Taft-Peirce.



T-P TAPER TESTING FIXTURE
combines a Sine Block with a pair of adjustable mounted precision centers. Checks tapers to high degree of accuracy.

For the complete story on these items and many more, get your copy of the Taft-Peirce Handbook.

T-P COMPARATOR SQUARE
permits accurate indication of squareness. Adaptable to both production and inspection work.

T-P means Top Precision

THE TAFT-PEIRCE MANUFACTURING COMPANY
WOONSOCKET, RHODE ISLAND

. . . IF IT'S A HIGH PRODUCTION PROBLEM . . .

ASK BAIRD ABOUT IT

TO GO FARTHER

FOR THE SAME "FARE"

get a Transfer

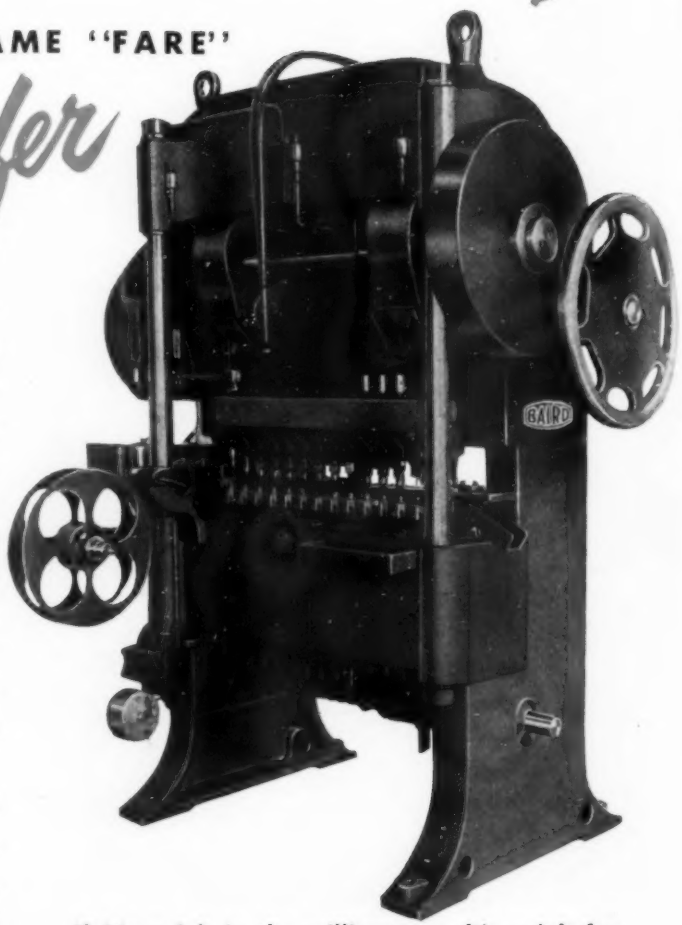
This one, completely automatic machine, the Baird Transfer Press, turns out accurately-formed metal parts at a rate of thousands of pieces per hour . . . often with 10 to 14 operations on each. Surely this is high production at its best.

Human-like transfer fingers automatically grip and carry the work to progressive die stations where blanking, drawing, piercing, embossing, slitting, trimming, sizing, hexing, forming, etc., complete the piece. Such operations combined in a single cycle definitely reduce costs to a great degree.

The machine pictured is but one of 12 standard sizes which have rated working pressures from 5 to 55 tons. Coiled stock from 2½" to 4" in width is automatically fed in feed lengths from 2" to 3½".

Tooling possibilities are almost endless . . . with set-ups that produce millions of small parts for the widest variety of uses.

Get yourself a "Transfer" for an extended "ride" to a favorable competitive position in this buyer's market. "Ask Baird about it." Write Dept. TE.



If it's a job in the millions . . . it's a job for

BAIRD *automatic*

MULTIPLE TRANSFER PRESSES

THE BAIRD MACHINE COMPANY

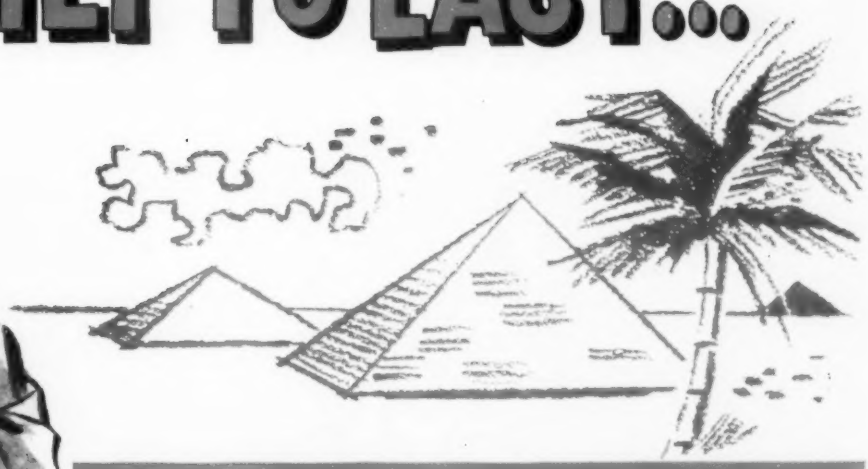
STRATFORD CONNECTICUT

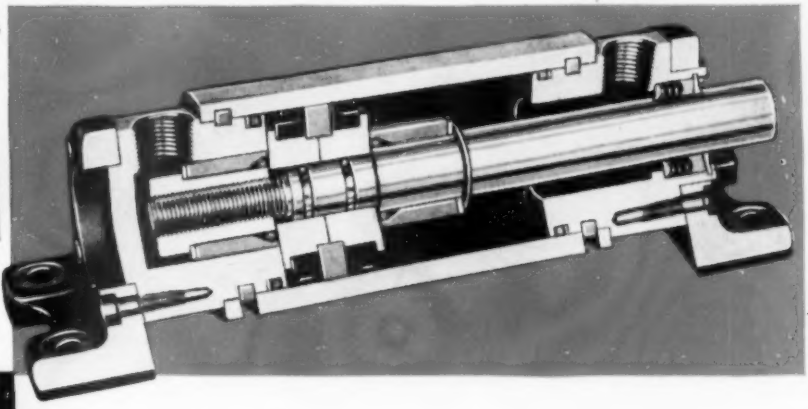
WHERE YOU WILL GET THE HELP OF SPECIALISTS ON THESE ESSENTIAL PRODUCTION PROBLEMS:

AUTOMATIC MACHINE TOOLS • AUTOMATIC WIRE & RIBBON METAL FORMING MACHINES • AUTOMATIC PRESSES • TUMBLING BARRELS

5BA54

BUILT TO LAST...





O-M CYLINDERS *(air-hydraulic)*

Designed and engineered with the user in mind, O-M Cylinders embody every essential construction and mechanical feature to assure trouble-free performance and long service.
They are built of steel with bearing surfaces of bronze—precision machined with modern equipment.
Cylinder bores are honed to a fine finish, and the hi-tensile piston rods are polished to give long life and smooth performance.
Effective O-ring static seals are backed up to prevent extrusion under high pressures. All packings are self-adjusting and are carefully selected for proper usage.
A rigid inspection at the factory is your guarantee of peak performance.
O-M Cylinders fit where others won't because O-M special interlocking mechanism eliminates bulging tie rods and end caps.
Available in a full range of sizes (1½" to 8" bores) with standard, 2 to 1 or oversize rods. *14-day delivery on most sizes.*

fit where others won't

Mail coupon now!

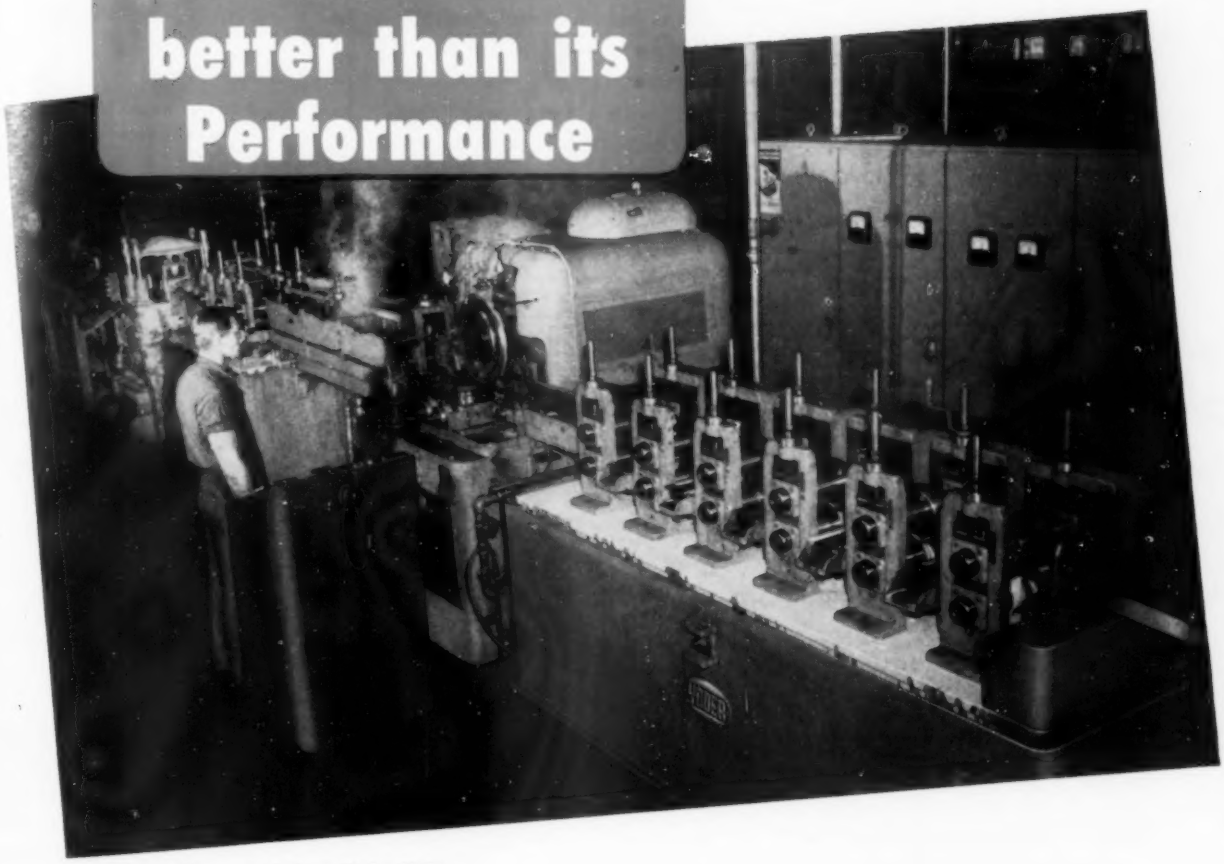
for FREE catalog and complete set of ½ and ¼-scale templates showing all cylinders and mounting brackets.

ORTMAN-MILLER MACHINE COMPANY
1216 150th Street, Hammond, Indiana

☐ Have representative call
☐ Please send latest O-M Catalog ☐ Complete Templates

Name_____ Position_____
Company_____
Address_____
City_____ Zone____ State_____

No Tube Mill is better than its Performance



Above: One out of three Yoder Tube Mills at Standard Steel Spring Co., Trenton, N. J. and Los Angeles, Cal.

Performance means production of good tubing, with minimum scrap losses, not only per hour or per day, but year in and year out. On this basis Yoder mills are most profitable in the long run.

Yoder mills have always been noted for their consistently high output, high weld strength and low scrap losses. Today, with the new Yoder 4-in-1 Cross-type Welding Transformer and other new features, their performance is more outstanding than ever.

And because most prospective buyers carefully investigate and compare performance records, there are more Yoder mills sold and in use than of all other electric resistance weld mills combined.

The Yoder Tube Mill Book tells the story of electric-weld tube making and answers many questions of interest to prospective tube mill owners. It's yours for the asking.

THE YODER COMPANY • 5525 Walworth Avenue, Cleveland 2, Ohio

Complete Production Lines

- ★ **COLD-ROLL-FORMING** and auxiliary machinery
- ★ **GANG SLITTING LINES** for Coils and Sheets
- ★ **PIPE and TUBE MILLS**–cold forming and welding

ENGINEERING YODER MANUFACTURING

More than meets the eye

P-K Socket Screws, at a glance, may look substantially like those you buy from "habit." You have to "look *beyond* the hex" for the difference.

If you don't, you are buying with a "blind spot" that can block your way to *proved* benefits other buyers are using to advantage. Parker-Kalon's exacting Quality Control is only one of the advantages you don't see until you "look beyond the hex."

Look Beyond the Hex

Compare every detail of product and service. Compare for advanced design . . . for proved assembly strength . . . for buying aids, and supply service. Get all the facts, and try P-K Socket Screws. You'll find they take top rating in any test.

Get samples, information from your P-K Distributor, or write: Parker-Kalon Division, General American Transportation Corporation, 200 Varick Street, New York 14, N. Y.

Two of the many steps in the exacting P-K Quality Control routine are illustrated. Left, the metallograph test to check metal structure, and right, the Magnaflux inspection, employing "black light" to reveal any defects.

FOR TOP QUALITY and tolerance gaged to your most exacting specifications — and guaranteed.

FOR ADVANCED DESIGN that speeds assemblies — makes them simpler, stronger — and saves errors.

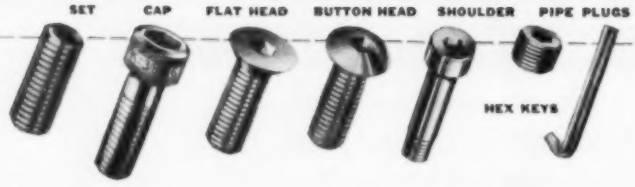
FOR ASSEMBLY STRENGTH okayed in a million punishing tests by thousands of satisfied users.

FOR PLANNING AIDS and buying data patterned to your special needs, plus advice on assembly.

FOR SUPPLY SERVICE set up for fast action and lower purchasing expense — by local Distributors.

FOR ANY STYLE OR SIZE You'll find any Socket Screw you need in P-K's complete line. Hex Keys in all sizes, and several handy sets.

PARKER-KALON SOCKET SCREWS



GET ALL THESE ESSENTIALS OF COST-WISE ASSEMBLY GET P-K

In Stock . . . see your nearby P-K Distributor . . . your local Supply and Service Specialist

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-9-192

If there's a better way to bore... Davis does it!

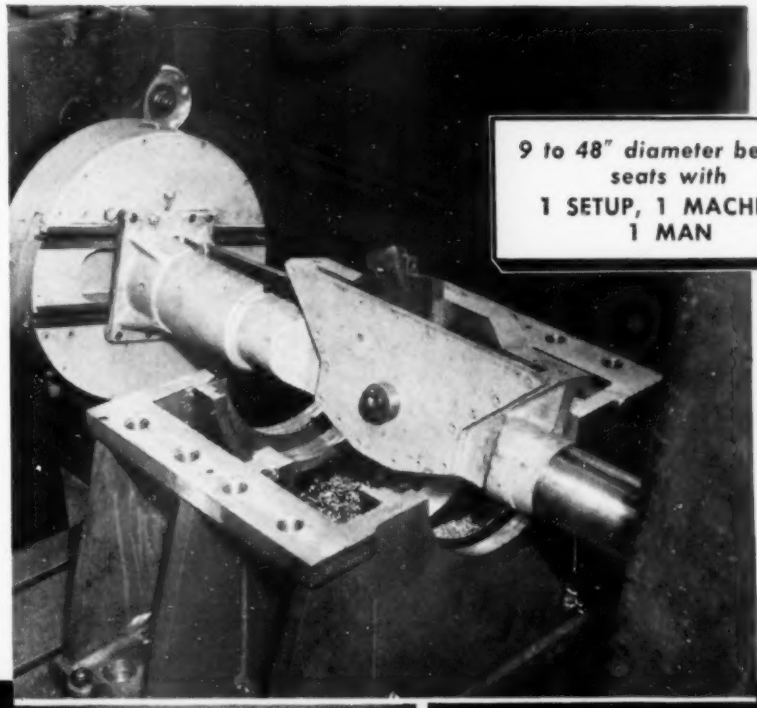
NEW spherical boring tools cut machining time, maintain closer tolerance, improve finish

--3 fast ways!

Here's another profitable operation performed by a Davis spherical boring tool, mounted on a continuous feed facing head. These special tools are currently being used in machining 9" to 48" bearing seats of pedestals and caps. High-speed steel and tungsten-carbide cutting tools are used.

As reported by a large electrical equipment manufacturer, the new tool has considerably reduced floor-to-floor time and tool breakage. What's more, it maintains closer tolerances and produces a better finish than was previously possible. The Giddings & Lewis continuous feed facing head, used to drive the spherical tools, is also used to complete all facing, straight boring and grooving on the same setup. Formerly, multiple setups on various machines were required.

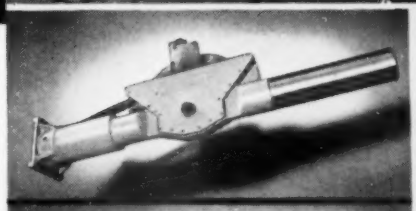
If you've a spherical boring problem, chances are one of the three types of Davis tools shown below is the answer.

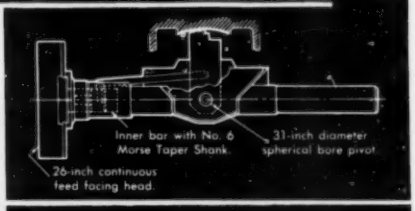


9 to 48" diameter bearing seats with
1 SETUP, 1 MACHINE, 1 MAN

1. FOR LARGER WORK—24 to 48" bore range

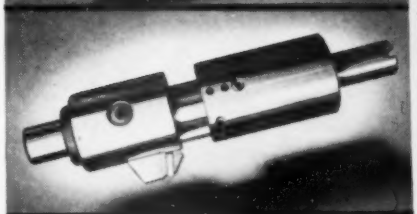
Spherical motion of block-type cutter is produced through the simultaneous action of tool rotation and spindle advance. Spindle arms and swinging arms are mechanically linked. Covers these ranges: 24 to 31", 31 to 39" and 39 to 48" in diameter.

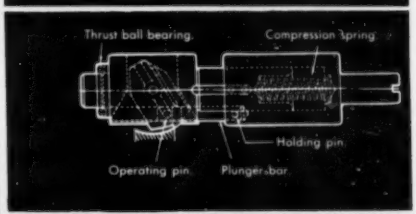




2. FOR MEDIUM WORK—8 to 12" bore range

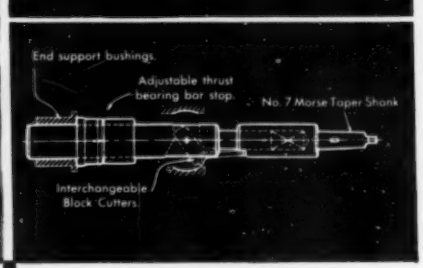
This tool is actually a bar within a bar. The cutting block is positioned by the ball thrust bearing contacting the face of the lathe spindle. Motion of outer bar relative to inner bar moves the block-type cutter through a spherical path.





3. FOR SMALLER DIA.—8 to 13" bore range

An adjustable stop collar that registers on the face of the end support bushing can be clamped anywhere along the bar. The collar positions cutter on the center of the proposed bore. Bar rotation and spindle advancement move cutter through an arc to produce the spherical bore.



What's your boring problem?
Davis offers you a complete tooling service to solve any routine or extraordinary boring problems. NEW spherical boring tool and complete Davis line are described in Catalog 304. Send for a copy today.

REMEMBER — if there's a better way to bore it — Davis will know it. And if Davis can't bore it — it can't be done!

DAVIS
BORING TOOL DIVISION
OF GIDDINGS & LEWIS MACHINE TOOL CO.
FOND DU LAC, WISCONSIN

DIXI 60

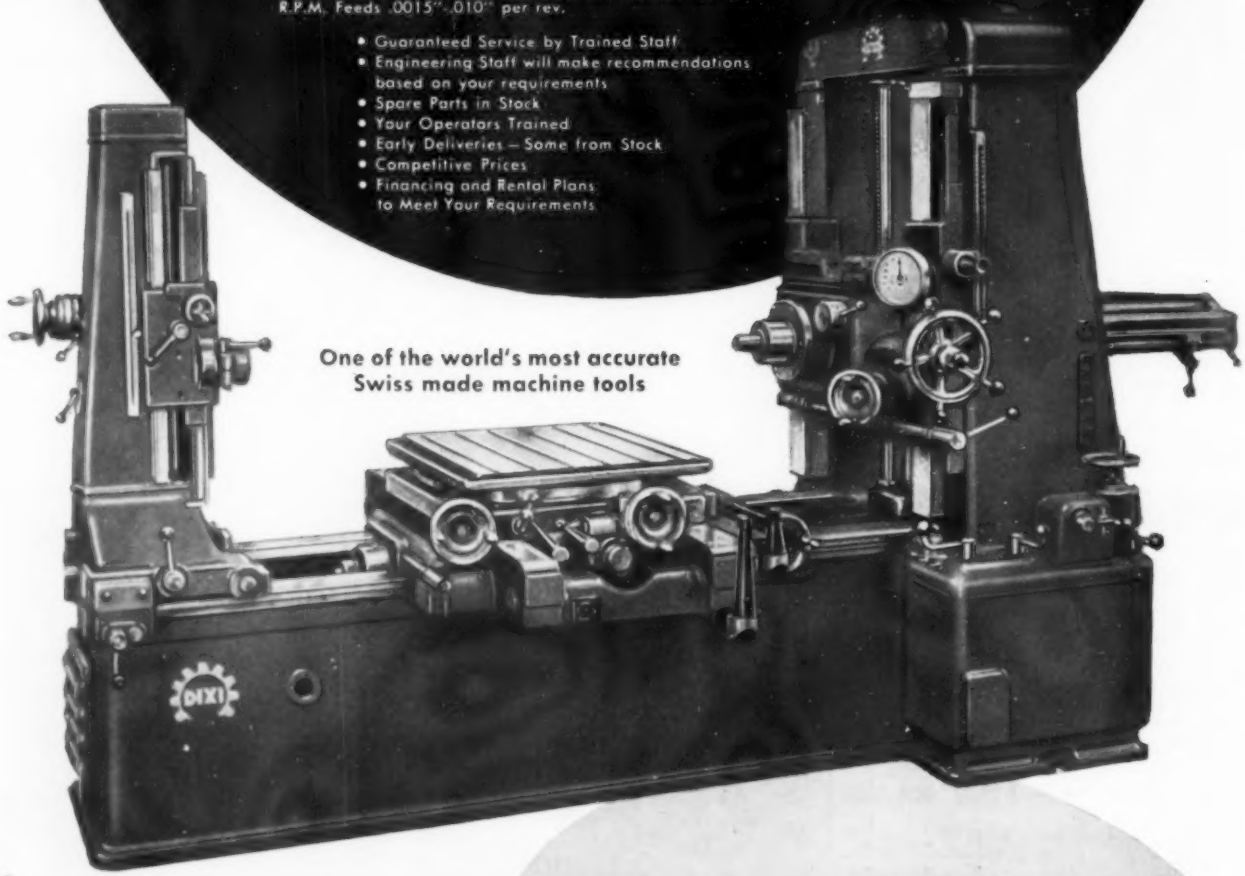
COMBINATION HORIZONTAL BORING MILL AND JIG BORER WITH OPTICAL MICROSCOPES

OUTSTANDING FEATURES:

A precision machine for drilling, boring, recessing, and milling work. Table can be rotated to 360 degrees. Accurate automatic locking of rotary table every 15 degrees, and at any other position by hand. Table and spindlehead have variable hydraulic feed. All coordinate dimensions can be set by dials, and adjustment made through optical microscopes. Mechanical spindle feed can be changed without stopping machine. Automatic stop of spindle feed. Optical measuring system operates in conjunction with vernier scales. Vertical movement of column motor operated.

Headstock, column, and table settings by optical microscopes to insure overall accuracy of .0002". Built in rotary table with optical microscope. Tables size 28¾" x 32⅝". Max. distance table to spindle 19.7". Table travel, 23⅝". Hydraulic feeds for all functions 0-78" per min. #40 Taper spindle. Spindle travel 24.4". Spindle speeds 32-1350 R.P.M. Feeds .0015"-.010" per rev.

- Guaranteed Service by Trained Staff
- Engineering Staff will make recommendations based on your requirements
- Spare Parts in Stock
- Your Operators Trained
- Early Deliveries – Some from Stock
- Competitive Prices
- Financing and Rental Plans to Meet Your Requirements



One of the world's most accurate Swiss made machine tools

DEALERSHIPS AVAILABLE

Over 20 years experience in designing and building machinery

Also United States distributors of low cost multi purpose vises • Tapping attachments • Quick change chucks and collets Wille-Grip keyless drillchucks • Milling machine arbors, adapters, arbor spaces and bearings • Lathe mandrels

Many More Machines For Every Operation
Write for free illustrated brochure 103, or state your specific requirements.

Exclusive Representatives in the United States

M. B. I. EXPORT & IMPORT LTD.

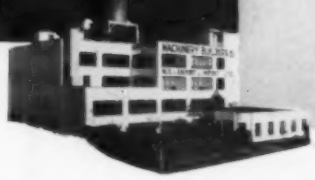
A Division of Machiney Builders Inc.

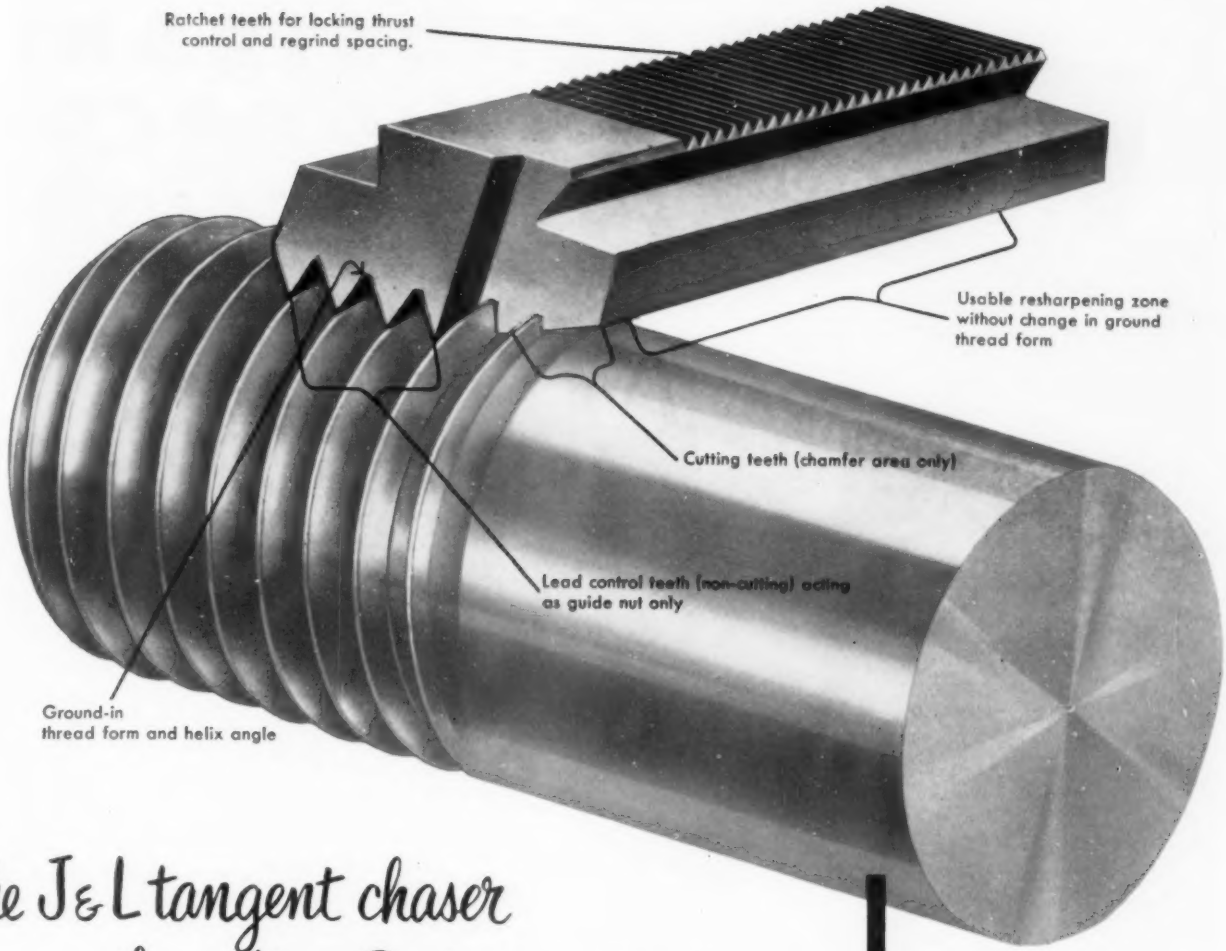
475 GRAND CONCOURSE, BRONX 51, NEW YORK

CABLE ADDRESS: MACHBUILD, NEW YORK

MBI

Our headquarters in New York City





the J&L tangent chaser threading System assures...

... ease of operation ... maximum accuracy and tool economy — by means of a true tangent method of thread cutting exclusively developed by Jones & Lamson.

All four chasers in the set are positioned tangent to the work, making them cut like any other end cutting form tool. J&L tangent chasers have the thread form ground in at the exact helix angle for the size and pitch being threaded. Cutting action is confined to the chamfered area and the first full tooth in a set. The non-cutting teeth, purposely end ground above center, act as a precision lead nut. The non-cutting teeth on all four chasers act as a steady-rest and help control the lead with extreme accuracy. Class III guaranteed. *This means important savings regardless of your tolerance requirements.*

Tangent Stationary Type
Capacities from #4 to 2"

Tangent Revolving Type
Capacities from #4 to 2"

Brown & Sharpe Types, capacities #0-1¼" — for #0 & #2 B&S machines & small turret lathes.

J&L Automatic Opening Die Heads and Chasers assure low initial cost — ease of operation — controlled resharpening — use of carbide where applicable. Class III threads guaranteed.

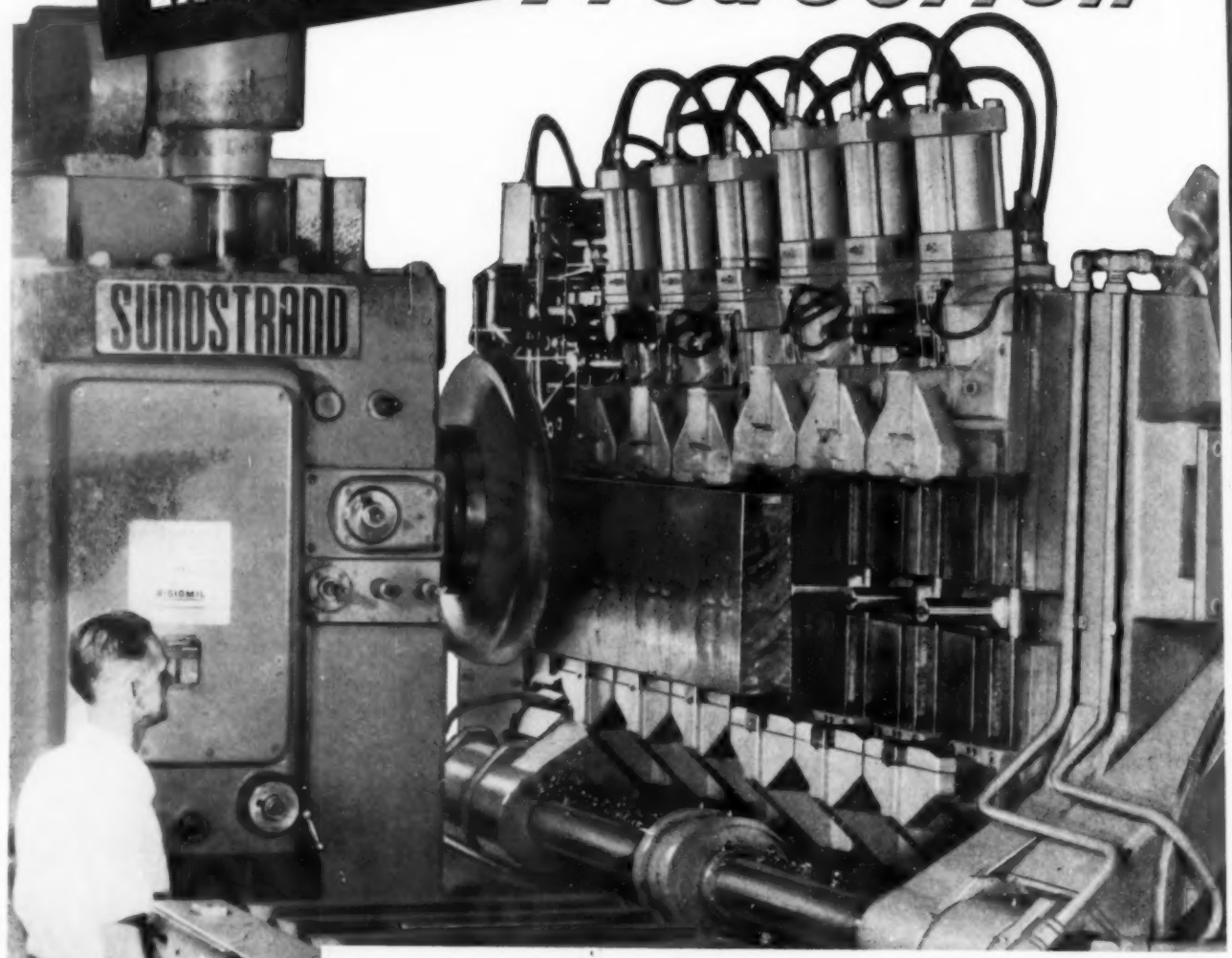
Write for free copy of *new* Jones & Lamson Tangent Die Head OPERATOR'S MANUAL.

JONES & LAMSON

Machine Tool Craftsmen Since 1835

JONES & LAMSON MACHINE CO., 518 Clinton St., Dept. 710, Springfield, Vt., U.S.A. J&L THREAD TOOL DIV.

Another Example of SUNDSTRAND "Engineered Production"



Operation view of machine showing scalping of one side of part.

Milling Production Increased 8 Times

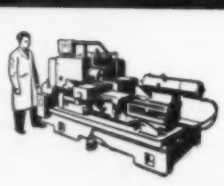
Here's a good example of how one company made profitable use of Sundstrand "Engineered Production" Service. In addition to handling a much wider range of sizes of parts, this Sundstrand Model 66 Rigidmil increased production approximately 8 times compared to previous method and equipment. Parts machined are copper base alloy cakes requiring milling on two sides. Handling of the many different sizes of parts is simplified by the special work-holding fixture and turnover equipment.

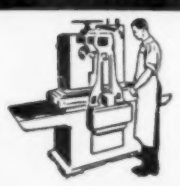
SUNDSTRAND

"Engineered Production" Service*

*REG. U.S. PAT. OFF.

AUTOMATIC LATHES | SIMPLEX RIGIDMILS | DUPLEX RIGIDMILS





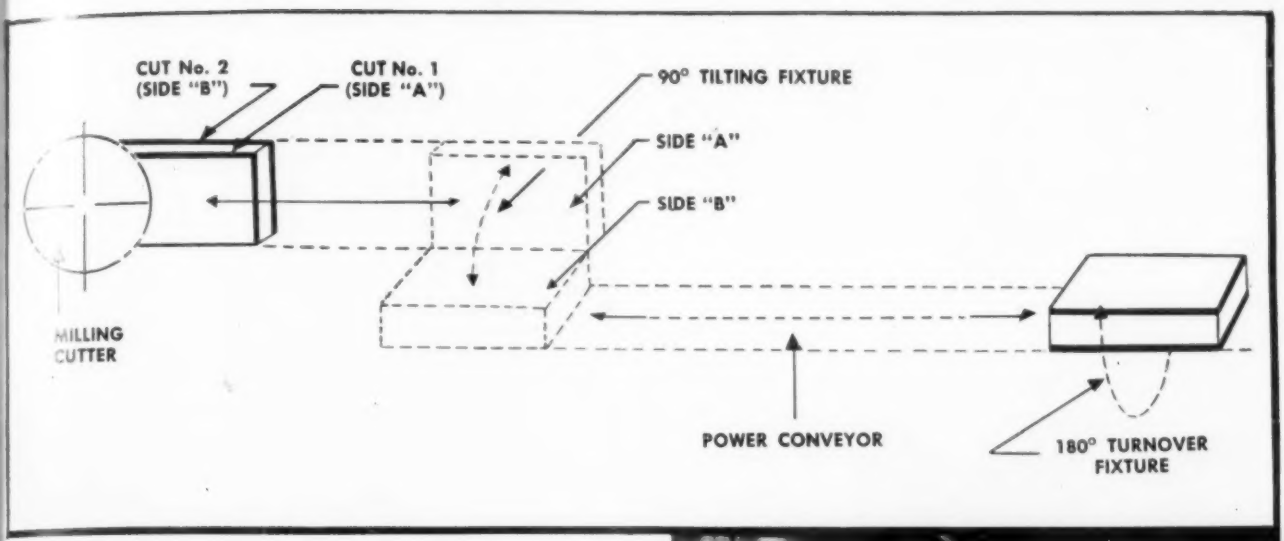
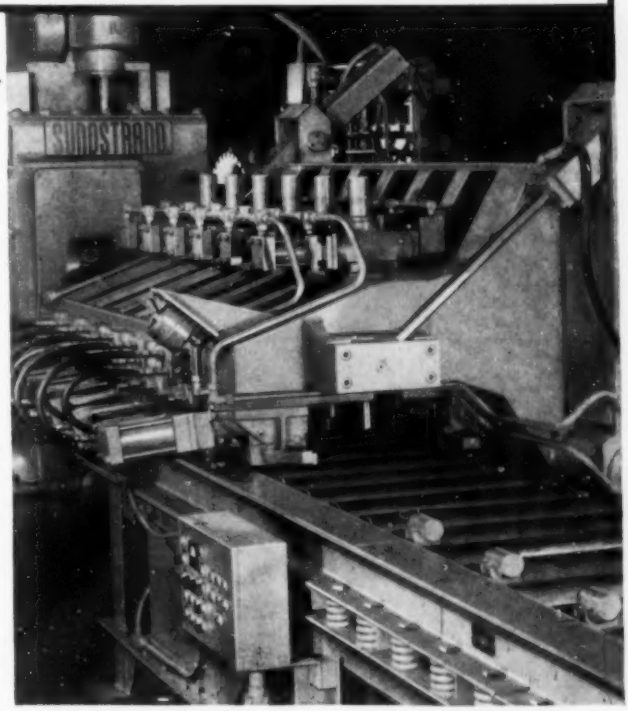


Diagram illustrating sequence of operations.

Close up of work-holding fixture in pick-up position. →



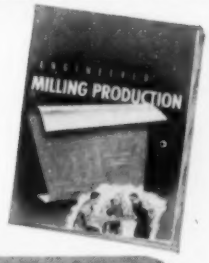
The complete cycle is controlled by the operator from a push button station. First the cakes are loaded onto the conveyor by crane. Then the hydraulically operated fixture is lowered and cake guided into clamping position on power-driven rollers. With the part clamped, the fixture is raised and fed past a 30″ diameter cutter for face milling one side. The fixture then rapid returns to its starting position and pivots down to the conveyor rollers. The clamps release the work onto the conveyor, and the rollers, now in reverse, carry the cake back into turnover fixture. The turnover fixture rotates 180° and places cake back on the rollers and the cycle is repeated for milling opposite side.

Use Sundstrand "Engineered Production" Service

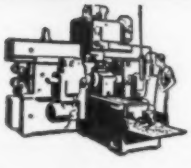
This is but one of many examples of the practical application of Sundstrand "Engineered Production" Service. This same service is available to you without obligation.

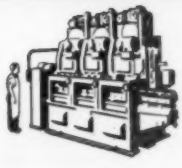
Free Data

Additional information on Sundstrand "Engineered Production" Service as applied to milling problems is included in this booklet. Write for your copy today. Ask for bulletin 747.



TRIPLEX RIGIDMILS | SPECIAL MACHINES



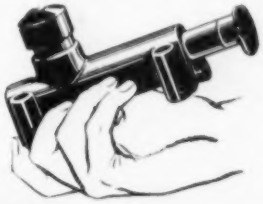


SUNDSTRAND
Machine Tool Co.
2540 Eleventh St. • Rockford, Ill., U.S.A.

In Jig and Fixture Components . . .

Get What You Want

With the recent addition of such new items as this heavy-duty jack with working parts of hardened-tool steel, Lodding now offers the most complete line of standard jigs and fixtures available.



STANDARDIZE With

YOU GET THE BEST

All Lodding fixtures are carefully engineered and quality-built to provide long, reliable service. Forgings and powdered metal are used in many cases. Every Lodding fixture is Parkerized to prevent rust.

AND YOU GET IT QUICKLY

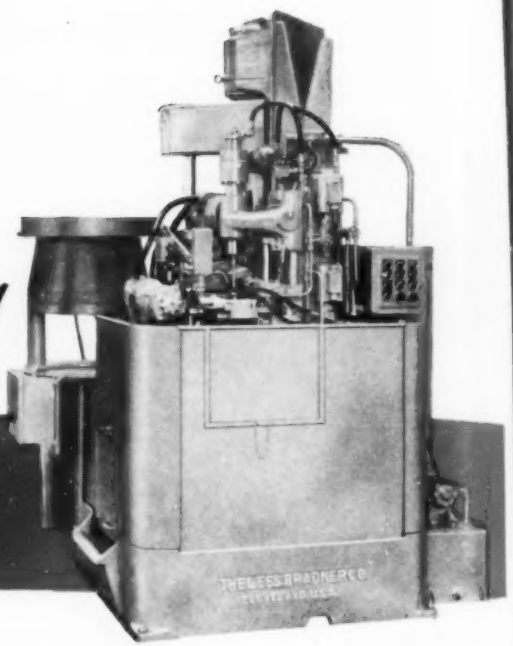
Immediate shipment from completely stocked, coast-to-coast distributors. You receive parts much faster than you can make them yourself.

Lodding
INC.
80 BEACON ST., WORCESTER 1, MASS.

THE STANDARD LINE
OF JIG AND FIXTURE COMPONENTS

Write for Catalog *— includes full-scale layouts of every Lodding fixture. No obligation.*

Automation is here ...from blank to gear!



MODEL 7-A "AUTOMATIC" SINGLE-SPINDLE HOBBER

3" diameter, single-start hob
Runs at 350 R.P.M.
Feeds at .050" per revolution
Hobs two pieces per load
Hobs one gear every 45 seconds
16 teeth in gear
Face width of gear: ⅛"
Loading and unloading time: 2 seconds

The famous Lees-Bradner 7-A single spindle hobber has now gone completely automatic!

From blank to finished gear the whole operation is "push-button". Here's how it works:

Blanks are fed from a Syntron Vibratory Feeder down a rack to an automatic pick-up arm or loader.

The loader picks up two blanks at a time and moves them to the hobbing position under an expanding mandrel. The mandrel holds the blanks while the hob moves forward automatically to commence the hobbing operation.

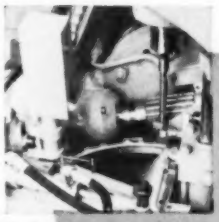
After the gears have been hobbed they are ejected by the loader as it sets the next two blanks in hobbing position.

As a control measure, the machine will not operate if:

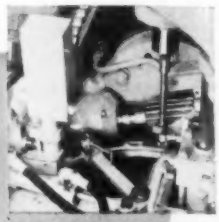
- **The blanks are not in the loader**
- **The blanks are not removed from the arbor**
- **There is not sufficient hydraulic clamping pressure**

In the operation pictured the machine is hobbing a pinion gear for an automatic transmission.

Write to the company for details on this amazing new automatic hobber.



1. Arbor retracted ready for loading.



2. Loader arm moves to right with 2 blanks.

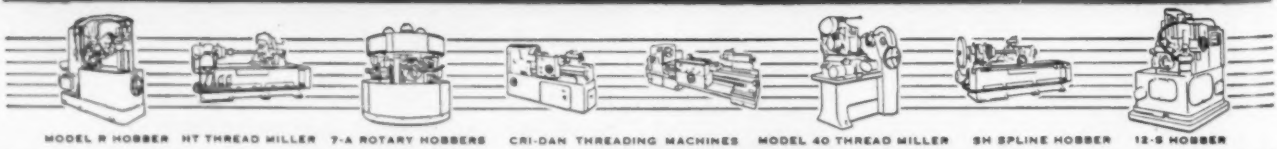
3. Loader about to eject finished gear from under mandrel.

4. Blanks held in place by mandrel ready for hobbing operation.

The Lees-Bradner 7-A Automatic Hobber is available in single units or quadruple mountings. (4 machines in line with common base, coolant tank, master control and feeder.)

the LEES-BRADNER Company

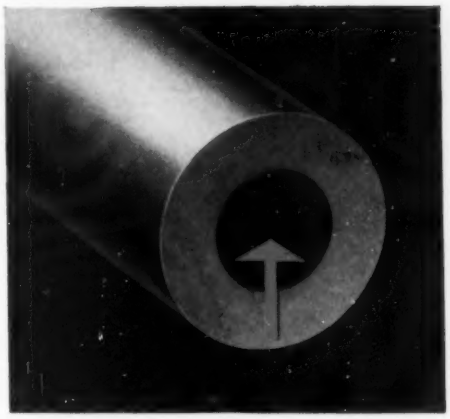
CLEVELAND 11, OHIO, U.S.A.



MODEL R HOBBER · HT THREAD MILLER · 7-A ROTARY HOBBERS · CRI-DAN THREADING MACHINES · MODEL 40 THREAD MILLER · SH SPLINE HOBBER · 12-S HOBBER

IF YOU THREAD OR HOB . . . GET A BETTER JOB WITH A LEES-BRADNER

a hole here is annoying . . .



a hole here is helpful

Crucible Hollow Tool Steel Bars are helping eliminate the wasteful practice of drilling out a solid bar to make ring-shaped, or tubular steel parts, or tools with a center hole. The hole is already in Crucible hollow tool steel bars . . . no need for drilling, boring, cutting-off or rough-facing operations.

You can get these hollow bars in any of Crucible's famous tool steel grades, in almost any combination of O.D. and I.D. sizes. And you can get *immediate* delivery of five popular grades—KETOS® oil-hardening, SANDERSON® water-hardening, AIRDI 150® high carbon-high chromium, AIRKOOL® air-hardening, and NU DIE V® work tool steels—from a conveniently located Crucible branch warehouse.

Call your Crucible representative for the full story of how these steels can best save you time and money. You'll be glad you did.

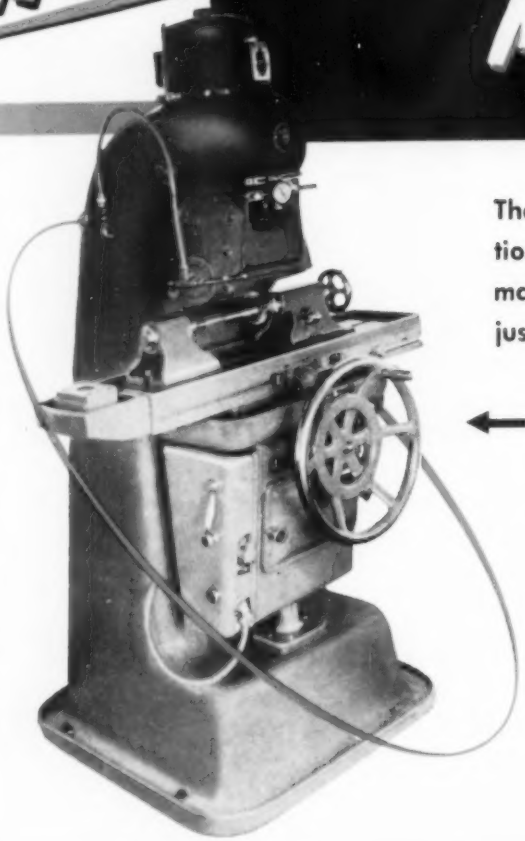
CRUCIBLE first name in special purpose steels

54 years of Fine steelmaking

HOLLOW TOOL STEEL

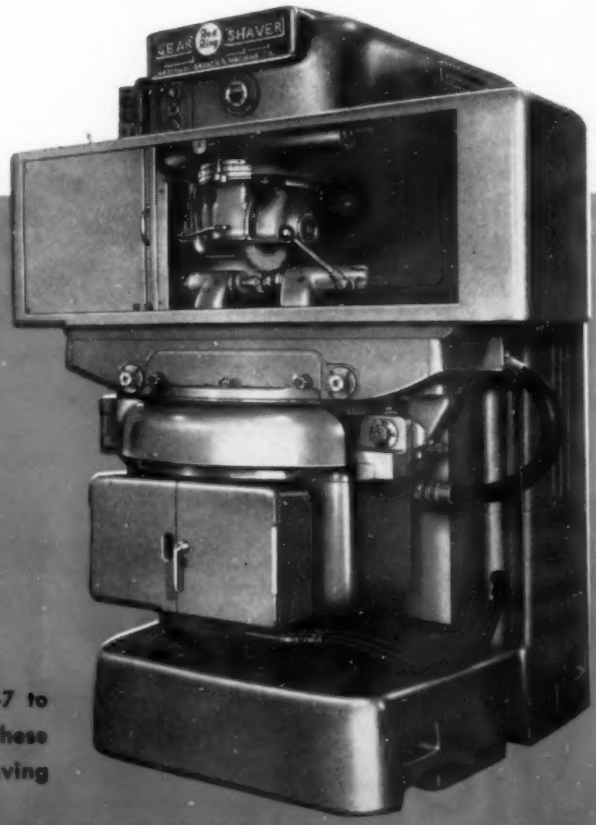
CRUCIBLE STEEL COMPANY OF AMERICA • TOOL STEEL SALES • SYRACUSE, N. Y

NOW IS THE TIME TO Cut Manufacturing Costs



The one sure way of meeting today's competition is with today's machine tools. The older machines were all right in their day but they just haven't got what it takes now.

← For instance, it took this old Red Ring Model GCC 60 seconds to shave a gear like the one shown. →



Model GCU today finishes that same gear in just 16 seconds—and to much closer tolerances, too.

In an 8 hour day the GCU will deliver 375% of the production of its predecessor.

Write for Bulletin S 53-7 to get all the facts on these new cost saving gear shaving machines.

6873

NATIONAL BROACH & MACHINE CO.

5600 ST. JEAN . . . . . DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

Here's the WAY to do it...

Kaukauna Machine Corporation fights wear and high bearing pressures with AMPCO* METAL

Kaukauna Machine Corp.
Kaukauna, Wisconsin

Product: Kaukauna Horizontal Drilling and Tapping Machine Model 3040.

Problem: To find a railslide way material that would provide dependable life in a tough service application. It had to resist high bearing pressures and maintain the close tolerances required in machine tool service. Wear was a problem — the slide travels at speeds up to 100 inches per minute. The material also had to provide superior bearing qualities to operate satisfactorily against the semi-steel bed casting.

Solution: **AMPCO METAL**

Results: The Ampco Metal ways show practically no wear in this tough, continuous service. That's how Ampco Metal helps Kaukauna guard its reputation for dependable operation and top-grade output.

And that's why you find Ampco Metal at critical points in all types of machine tools — wherever wear and high bearing pressures are factors.

IT'S PRODUCTION-WISE TO AMPCO-IZE!

AMPCO Metal has high compressive strength — won't squash out. It has remarkable resistance to wear in all its forms—abrasion, corrosion, erosion, cavitation-pitting, etc. Ampco Metal gives you high impact and fatigue values — makes a superior bearing material. That's why it is often called "the Metal without an Equal."

Ampco Metal is easy to use — available in practically any form you need. You can get it in sand and centrifugal castings, sheet, plate, fittings, and fasteners. Also available as forgings, tubes, bars, extruded shapes, and welded electrodes and wire.

Perhaps Ampco Metal is the answer to wear, shock, load, and many other troublesome problems you face. Let it help you to build greater customer satisfaction into your product, or to obtain higher production, lower costs, longer runs in your plant. Get complete information on any application from your nearby Ampco field engineer or write us.

*Reg. U. S. Pat. Off.

Tear out this coupon and mail today!

Ampco Metal, Inc.
MILWAUKEE 46, WISCONSIN
WEST COAST PLANT,
BURBANK, CALIFORNIA

LET AMPCO PROVE ITS ~~METAL~~ *mettle*

AMPCO METAL, INC., Dept. TE-9, Milwaukee 46, Wisconsin
I'd like to know more about Ampco Metal. Kindly send me your descriptive literature without obligation.

Name..... Title.....

Company.....

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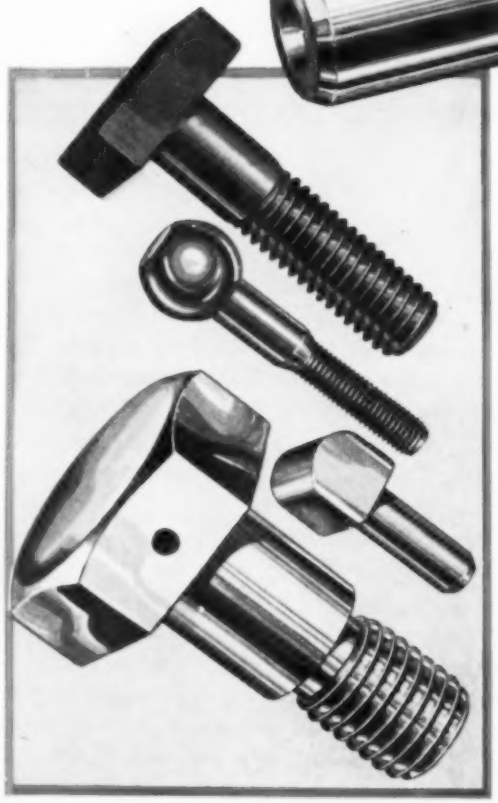
D-24A

Which is the CleCap?



...it could be both _____ made by fast economical CleCap processes

It just might pay you to take a good look at the special parts you're buying that could be made more economically by CleCap's hot heading or cold extrusion processes. Quite a number of our customers have done it . . . and they like what happened.

The forged blank (a) above was produced for one user. He finished it as it's shown at (b). CleCap pre-forms your non-standard parts for further shaping and machining in your plant or manufactures them complete, ready for your assembly line. You'd be surprised at all the different shapes we've turned out.

You can save yourself tooling and machine time. Take a look at what CleCap offers—engineering skill and experience in applying high production methods and machines to your problems. Anyway, write for folder, "Specials by Specialists".

Cleveland *Top Quality* Fasteners

FERROUS AND NON-FERROUS

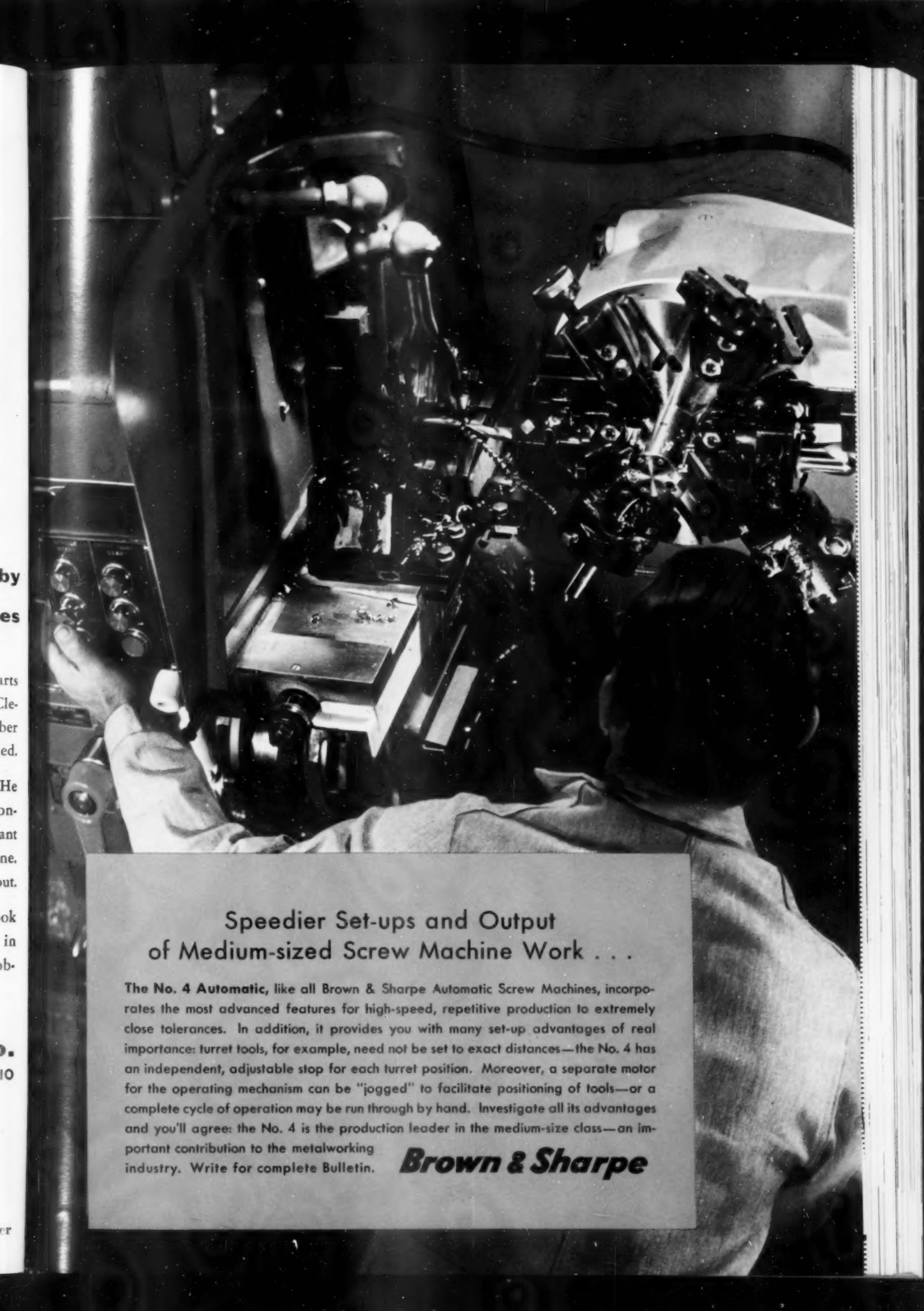
Hexagon Head Cap Screws • Socket Head Cap Screws—Plain & Knurled; also Flat and Button • Flat Head and Fillister Head Cap Screws • Place Bolts • Structural Bolts • Tractor Bolts • Square Head Set Screws • Socket Set Screws • Milled Studs

The Cleveland Cap Screw Co.

2944 EAST 79th STREET • CLEVELAND 4, OHIO

VUlcan 3-3700 TWX CV42

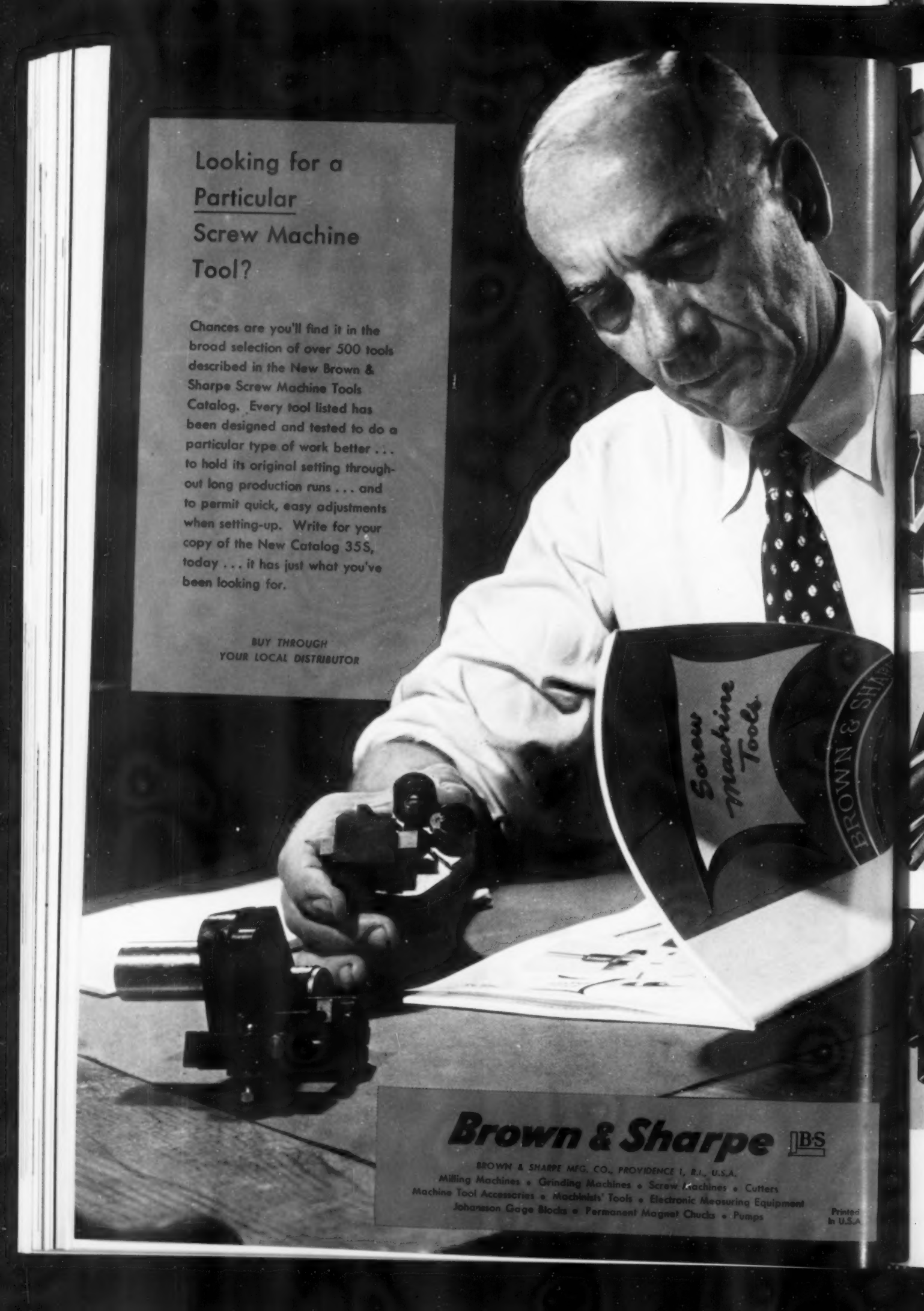
Originators of the Kaufman DOUBLE EXTRUSION Process



Speedier Set-ups and Output of Medium-sized Screw Machine Work . . .

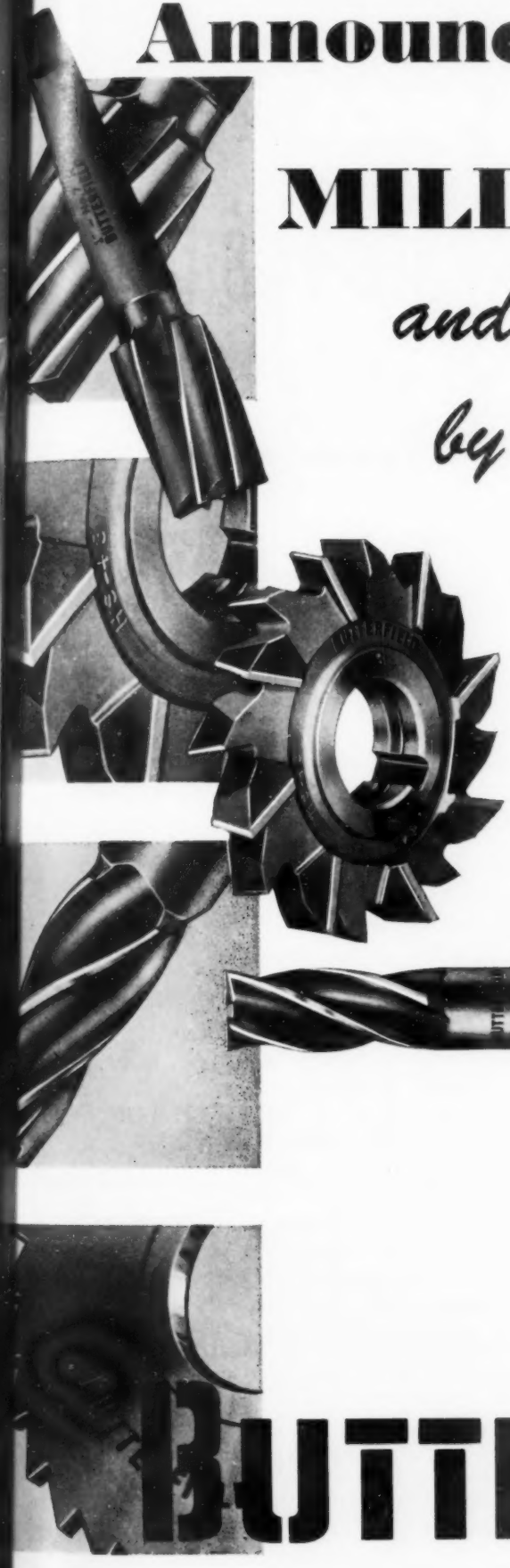
The No. 4 Automatic, like all Brown & Sharpe Automatic Screw Machines, incorporates the most advanced features for high-speed, repetitive production to extremely close tolerances. In addition, it provides you with many set-up advantages of real importance: turret tools, for example, need not be set to exact distances—the No. 4 has an independent, adjustable stop for each turret position. Moreover, a separate motor for the operating mechanism can be "jogged" to facilitate positioning of tools—or a complete cycle of operation may be run through by hand. Investigate all its advantages and you'll agree: the No. 4 is the production leader in the medium-size class—an important contribution to the metalworking industry. Write for complete Bulletin.

Brown & Sharpe

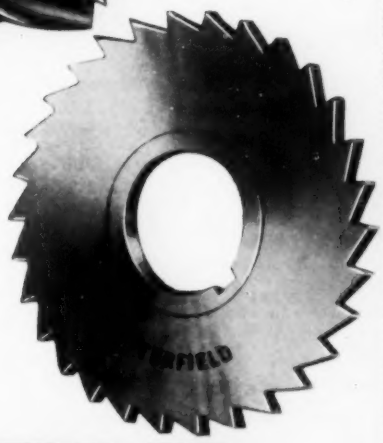

Looking for a
Particular
Screw Machine
Tool?
Chances are you'll find it in the broad selection of over 500 tools described in the New Brown & Sharpe Screw Machine Tools Catalog. Every tool listed has been designed and tested to do a particular type of work better . . . to hold its original setting throughout long production runs . . . and to permit quick, easy adjustments when setting-up. Write for your copy of the New Catalog 35S, today . . . it has just what you've been looking for.
BUY THROUGH
YOUR LOCAL DISTRIBUTOR
Screw Machine Tools
BROWN & SHARPE
Brown & Sharpe
BROWN & SHARPE MFG. CO., PROVIDENCE 1, R.I., U.S.A.
Milling Machines • Grinding Machines • Screw Machines • Cutters
Machine Tool Accessories • Machinists' Tools • Electronic Measuring Equipment
Johansson Gage Blocks • Permanent Magnet Chucks • Pumps
Printed In U.S.A.

Announcing

MILLING CUTTERS *and* END MILLS *by* Butterfield



With the addition of Milling Cutters and End Mills, Butterfield now offers a full line of metal cutting tools. Milling Cutters and End Mills are made to the same exacting standards of dependability and extra performance which mark Butterfield's Taps, Dies, Drills, Reamers, Counterbores, and Screw Plates.



BUTTERFIELD

UNION TWIST DRILL COMPANY
BUTTERFIELD DIVISION
DERBY LINE, VERMONT, U.S.A.

TAPS · DIES · DRILLS · REAMERS · COUNTERBORES · SCREW PLATES · MILLING CUTTERS · END MILLS

FOR BETTER SERVICE
CALL YOUR
BUTTERFIELD
DISTRIBUTOR

Announcing the Moore-Fosdick

The only machine of its kind in

• Greater range—22" x 42" x 27" height • Automatically positions work to ±.0001"

• Grinds jigs, dies, punches, templates and machine parts • Infinite Grinding Speeds—12,000 to 60,000 rpm • Contour and Chop Grinding • Slot Grinding Attachment • Spindle-Housing Heat Control

This new machine combines the unique Moore Jig Grinding Head with the exclusive Fosdick Automatic Positioning Table. It gives you greater capacity for precision grinding with the speed and convenience of a table that automatically positions work to ± .0001". *There is no other machine in the world that even approaches the Moore-Fosdick in jig-grinding capacity, versatility, convenience and precision!*

Grinds Cylindrical and Tapered Holes. The Moore-Fosdick allows you to grind cylindrical as well as conical holes, with taper in either direction. An angular and indexing device built into the main spindle, and the newly developed slot grinding attachment, permit the quick, accurate grinding of any contour—*regular* or *irregular.*

Large Work Capacity—Infinite Number of Speeds. The Moore-Fosdick A. P. Jig Grinder has an infinite range of grinding speeds – from 12,000 to 60,000 rpm . . . allowing extreme versatility and accurate control of grinding and stock removal. Larger table size and greater work height, coupled with greater power, *extend* the overall range of precision grinding operations.

S P E C I F I C A T I O N S

Capacity:	**No. 30-G**	**No. 42-G & No. 42-PG***
Table size	36"x18"	44"x22"
Table travel, Longitudinal	30"	42"
Table travel, Crosswise	17½"	22"
Table top to wheel collet	2" to 27"	2" to 27"
Spindle to column ways	18½"	18½"
Spindle to column below ways	20"	25¼"

Four spindle speeds: 90, 120, 180, 240

Spindle feeds by air-powered hydraulic control—infinite speed control

Grinding speeds: 12,000 to 60,000 rpm; 3 heads

Grinding Capacity:
With grinding wheels, 3/16" to 5" (8" with adapter)
With diamond mandrels 1/64" to 3/16"

Travel main spindle slide . . . 3¾"

Angular adjustment of spindle up to 1½° either way or 3° included angle.

Radial offset of grinding spindle-from center to 1⅛" off center by rough adjustment-while running 0.0001" adjustment for distance of 0.075" anywhere in the 1⅛" range.

Weights and Floor Space:	**No. 30-G**	**No. 42-G & No. 42-PG**
Machine with regular equipment, including motor	6000 lbs.	11,000 lbs.
Shipping weight	6750 lbs.	12,000 lbs.
Floor space	77"x82"	102"x128"

Standard Equipment:
Four-speed constant torque ¼ hp motor, 220-440 volts, 50-60 cycles, 2-3 phase, wheel dresser—micrometer stop-wrenches. Two built-in locating devices: two 1" .0001 inside micrometers; two 1", 2", 3", 4", 5", 10" and one 15" end measurers in box.

Compressed Air Requirements:
90 to 100 lbs. @ 15 cfm, furnished by customer. We recommend a heavy-duty 7.5 hp air compressor with a water aftercooler, provided it is capable of this output.

*42-PG Moore-Fosdick Jig Grinder with Automatic Positioning.

Write today
for price and delivery information.

ig Grinder

he world!

Positions Work Automatically to ± .0001". With the Automatic Positioning Table, you can get fast and accurate positioning of parts to be ground. Two simple duplicating bars may be prepared to position work automatically to ± .0001" – at the touch of a pushbutton. This means that complex grinding jobs with hundreds of holes require only one set-up. On "one-time" jobs, measuring rods can be used in place of bars. For precision production jobs, the easily-made, easily-stored duplicating bars give you a permanent record of positions. Once a job is run, you store the bars and use them every time you rerun that same job – weeks, months or years later.

Grinder Head Dimensional Stability. Latest design of the grinding head incorporates new features to improve further its stability. These include: (1) Electric heating elements in the main spindle housing to maintain uniform temperature whether machine is running or not; (2) An observation thermometer so located as to indicate any temperature change within the housing; (3) The housing itself is cast from 36% nickel iron to reduce the effect of any possible temperature variation to an irreducible minimum.

Need Drilling Equipment? Get a Proposal from Fosdick!

Radial Drills | Jig Borers | Sensitive and Upright Drills | Sensitive Radial Drills | Automatic Positioning Machines

FOSDICK

THE FOSDICK MACHINE TOOL CO., CINCINNATI 23, OHIO

with TOCCO Induction Heating

Mechanics Universal Joint Division of Borg-Warner Corporation now combines automatic heat-treating and metal-working operations on the same machine!*

A Tocco Inductor Coil, matched to one spindle of a multiple spindle automatic screw machine, heat treats the inside diameter of automotive trunnion cups—after they have been completely formed on the same machine tool. Twenty-two, 20 and 50 kw, 450,000 cycle TOCCOtron Induction Heating units and 44 automatic screw machines (installed here and in other plants) make up this high-speed production team.

This new method permits the use of SAE 1144 steel and eliminates costly, time-consuming copper plating and carburizing operations formerly required. Heating and quenching cycles total approximately 10 seconds per part, and production is in excess of 300 parts per hour from each machine.

If your products or their components require heat treating, soldering, brazing or forging it will pay you to investigate TOCCO for better, faster ways of producing them at lower unit cost.

*A patented process

THE OHIO CRANKSHAFT COMPANY

TOCCO

*Trade Mark Reg. U. S. Pat. Off.

Mail Coupon Today

NEW FREE BULLETIN

THE OHIO CRANKSHAFT CO.
Dept. G-9, Cleveland 1, Ohio

Please send copy of "Typical Results of TOCCO Induction Hardening and Heat Treating."

Name_____

Position_____

Company_____

Address_____

City_____ Zone____ State_____

MODEL 96-05 CHUCK WITH ITS TAPER SHANK ARBOR

MODEL 96-F1 SHOWING ITS BACK MOUNTING FLANGE

NOW! New Jacobs Model 96 Rubber-Flex Collet Chuck

brings famous grip to whole new group of applications

Grinders! Milling machines! Jig borers! Jig grinders! Lathes! Various types of special machinery where precise compact collet closure is vital!

ALL get the benefit of the famous Jacobs Rubber-Flex Collet grip in the new Jacobs Model 96 Collet Chuck.

The long, steel jaws of this collet — locked together with oil-resistant synthetic rubber — provide an absolutely parallel grip over the entire bearing surface.

What's more, each collet has a full ⅛" range so that the standard set of eleven Rubber-Flex Collets cover the gripping range of eighty-eight split steel collets! A geared key tightening device and self-tightening toggle action of the collet jaws give the chuck gripping power far beyond that obtained with split steel collets. Chucks any diameter bar between 1/16" and 1⅜".

For work holding: Model 96 Collet Chuck permits precision chucking of bright finished bars, with close or wide tolerance diameters, resilient or compressible materials, tubing and brittle materials such as ceramics or glass.

For tool holding: Model 96 Collet Chuck can be used for drilling and reaming on jig borers and other high precision machines, holding proving bars and indicators. Extreme accuracy and wide capacity range make it ideal for tool and cutter grinding on cylindrical and cutter grinders.

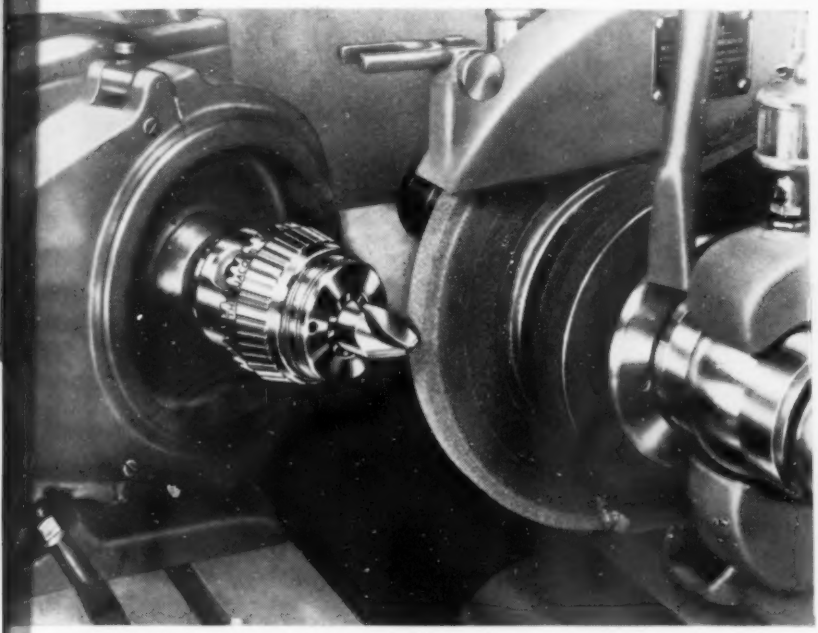
TWO MODELS: Model 96-05, $135.00; Model 96-F1, $150.00. Rubber-Flex Collets, $12.00 each.

For further details, ask your Industrial Supply Distributor for Catalog 54-CC. The Jacobs Manufacturing Company, West Hartford 10, Conn.

Jacobs
RUBBER-FLEX COLLETS

PRECISION REAMING ON JIG BORER with Model 96-05.

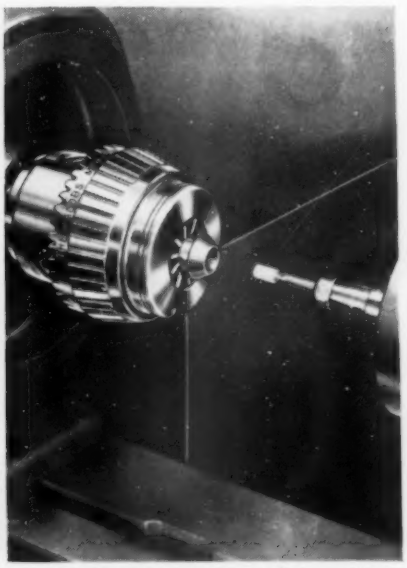
NEW JACOBS MODEL 96-F1 COLLET CHUCK on magnetic chuck holds work for surface grinder.



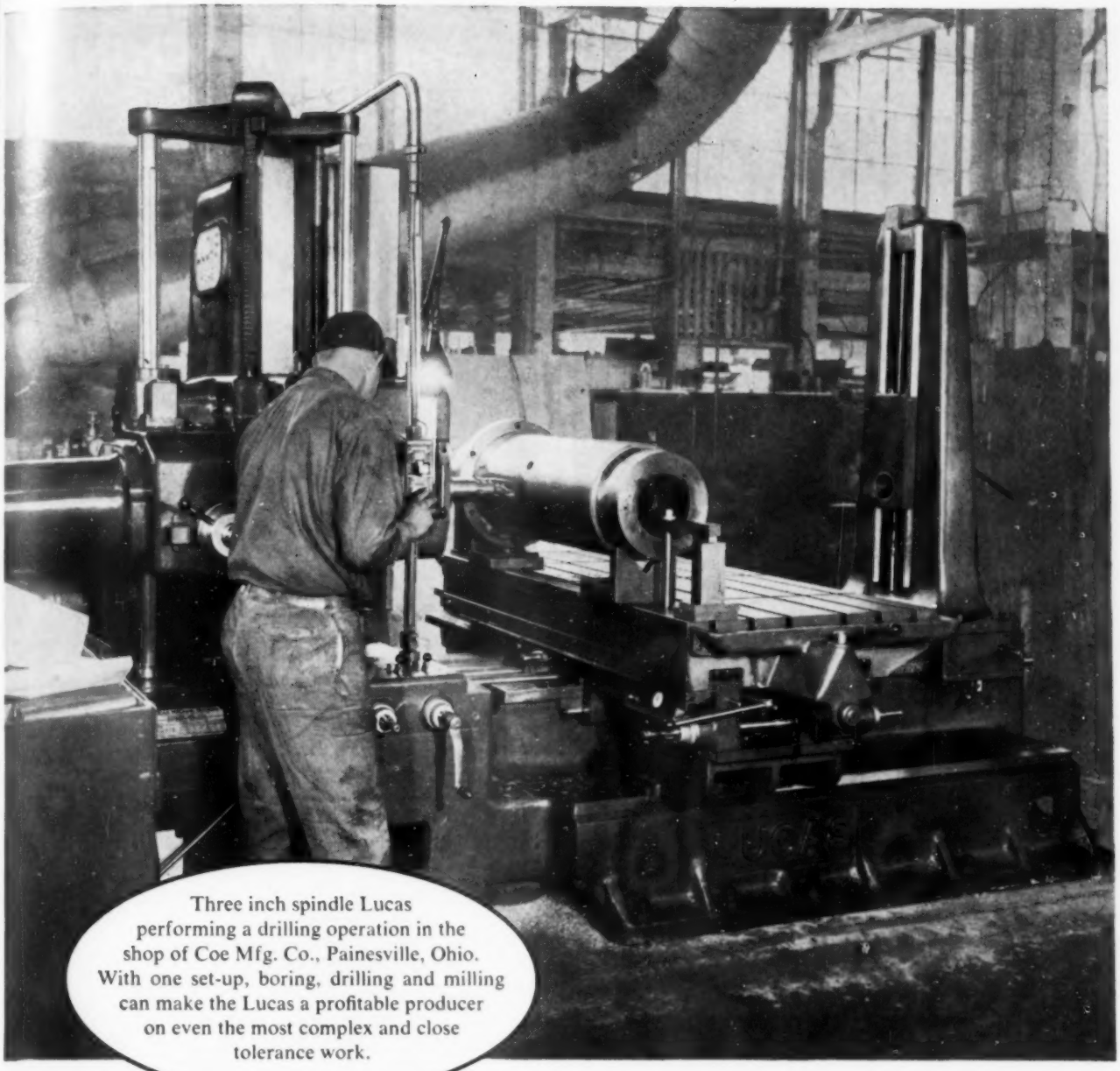
MODEL 96-05 ADAPTED TO HEADSTOCK OF CYLINDRICAL GRINDER.

CHUCKING WORK ON VERTICAL MILLING MACHINE with Model 96-F1.

NEW CHUCK Model 96-F1 here holds work on jig grinder.



PRECISION BUSHING GRINDING with Model 96-05.



Three inch spindle Lucas performing a drilling operation in the shop of Coe Mfg. Co., Painesville, Ohio. With one set-up, boring, drilling and milling can make the Lucas a profitable producer on even the most complex and close tolerance work.

If you operate a contract shop, JUST ONE LUCAS will enable you to out-bid competition on a wide variety of work.

It will prove to be your most versatile and PROFITABLE machine — on one piece or a thousand — because it can perform a wider variety of operations than is possible on any other machine in your shop.

On many contracts your new Lucas will cut a big slice out of your COST DOLLAR and add substantially to your PROFIT DOLLAR.

A moderate investment will put this smaller size 3" spindle, table type Horizontal Boring Machine to work making money for you.

Write for the NEW Lucas catalog — just off the press.

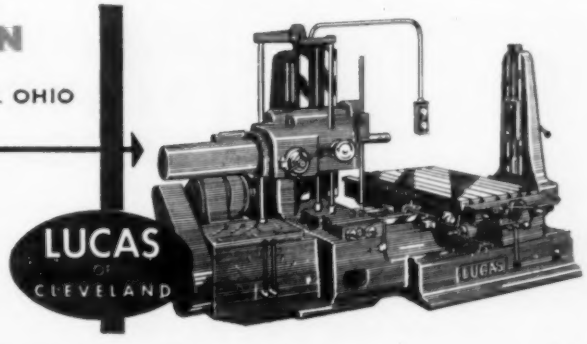
LUCAS MACHINE DIVISION

THE NEW BRITAIN MACHINE COMPANY • CLEVELAND 8, OHIO

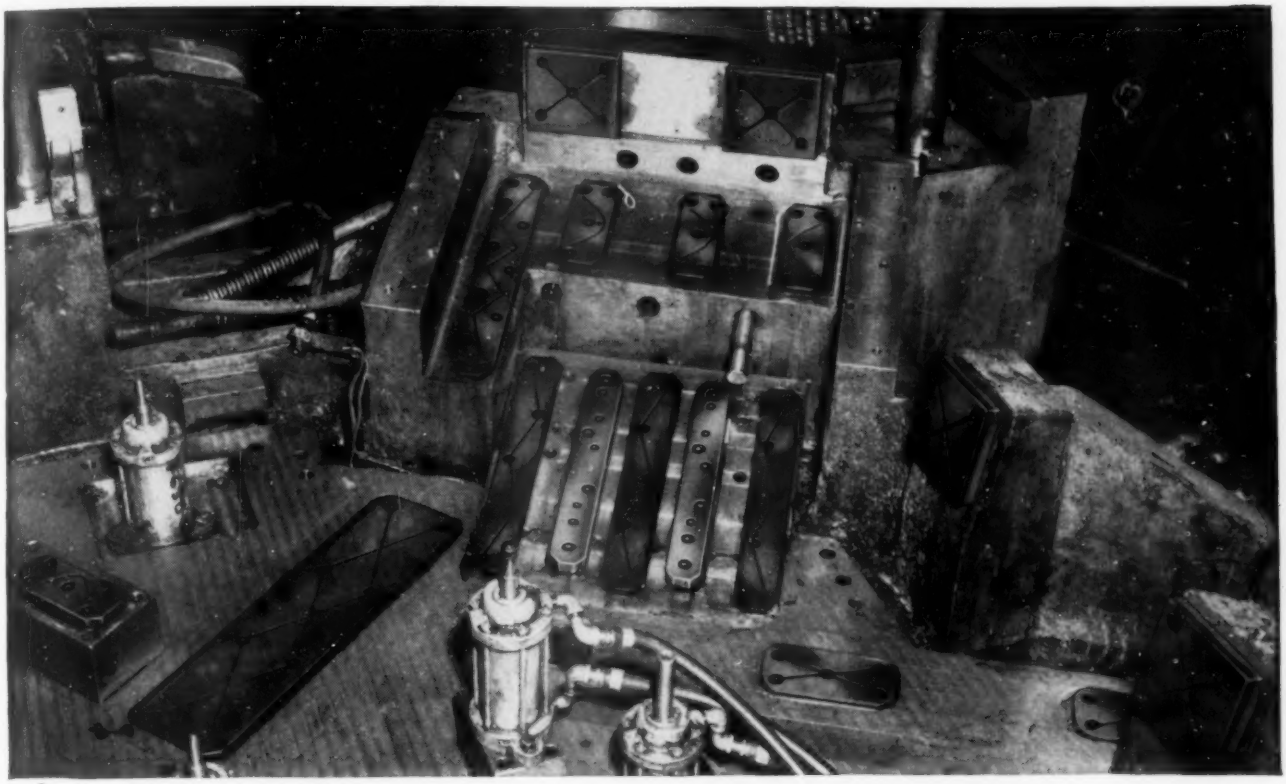
. . . Machines for Making Progress

Three, four, five and six inch spindle
Lucas Horizontal Boring, Drilling and Milling Machines

Our general catalog is filed in the Sweet's Machine Tool Catalog File.



IT'S OK WHEN YOU FOLLOW THE LEADERS



The automotive industry stands as a leader in technological advancement and cost-cutting production techniques. That's why today practically every important automobile manufacturer is using Ohio Knife Aluminum Bronze Wear Plates on body dies.

By a unique cladding process, long-wearing aluminum bronze is bonded to a machinable steel base. Cost is drastically lower when compared to solid cast bronze plates. A finer quality bearing surface is obtained, resulting in longer life. When fitting is required to suit die, steel backing of plate is easily machinable, and no difficulty is encountered drilling or counter boring through bronze surface. OK aluminum bronze plates are applicable wherever a die has a sliding or cam action. A large selection of OK aluminum bronze plates carried in stock . . . finished ground, flat and parallel . . . ready to ship. Specials made to your specifications. Literature available showing our standard sizes. Write Dept. 29-U

Manufacturers for the metalworking industry of:

SLITTER KNIVES • SHEAR BLADES • BRONZE WAYS • ROTARY SHEAR KNIVES
HARDENED SPACERS • BALL RACES • HARDENED WAYS • WEAR STRIPS • GIBS

THE OHIO KNIFE CO.

CINCINNATI 23, OHIO

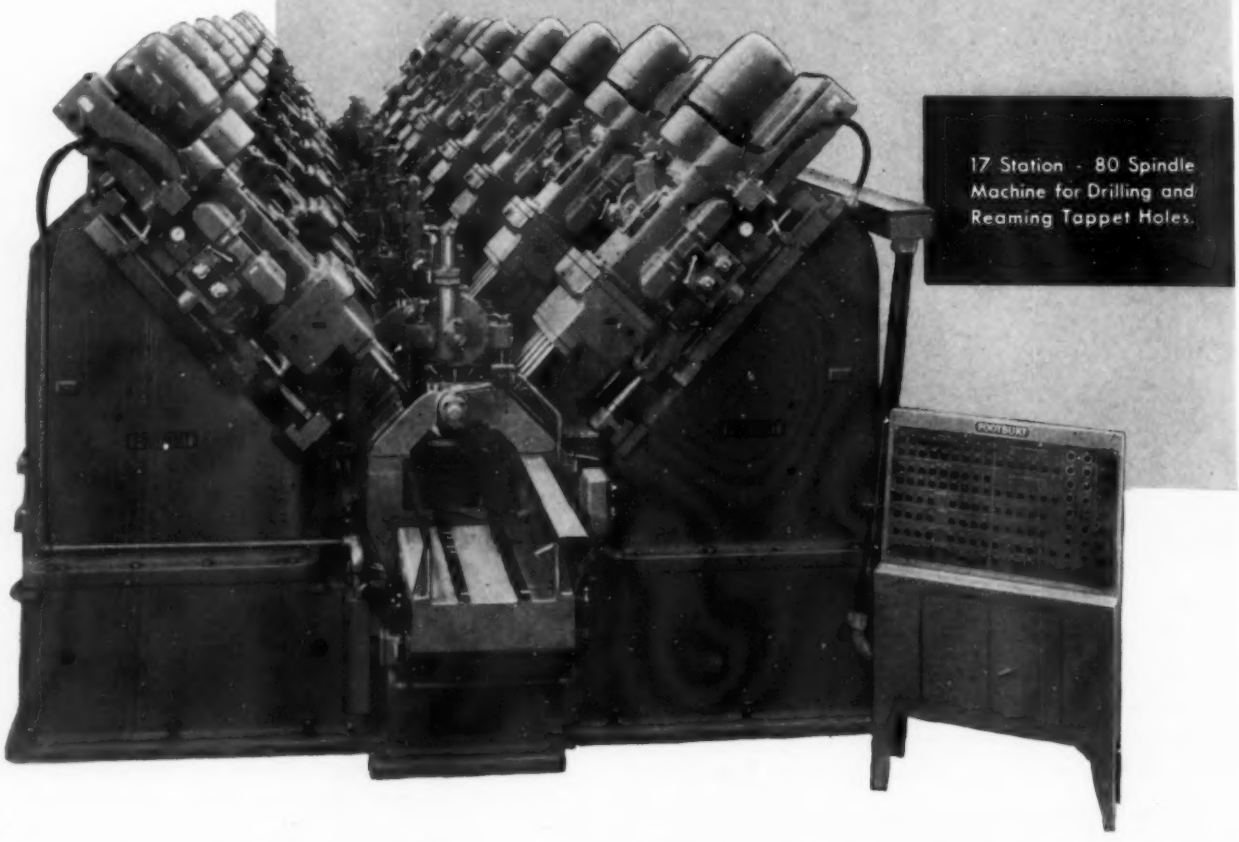
FOOTBURT

STATION TYPE MACHINES

Production-wide engineers in leading automotive plants are specifying Footburt Station Type Equipment on cylinder blocks and cylinder heads as the most advanced method in quantity manufacturing. Similar operations that ordinarily require several separate machines are grouped in one station machine, thus greatly reducing handling and providing better production control. Combining of valve hole operations, cylinder boring, the majority of drilling and tapping operations are outstanding examples of this latest production trend.

THE FOOTE-BURT COMPANY • Cleveland 8, Ohio

Detroit Office: General Motors Building



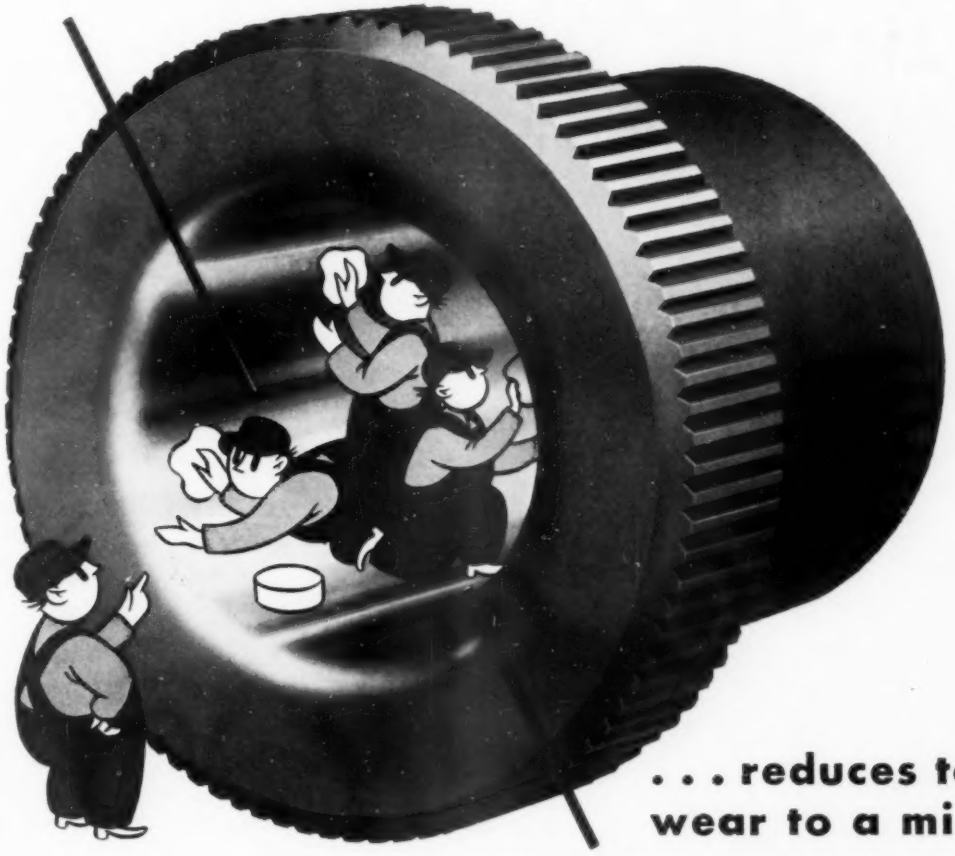
17 Station - 80 Spindle Machine for Drilling and Reaming Tappet Holes.

engineered for production

FOOTBURT

MACHINE TOOLS

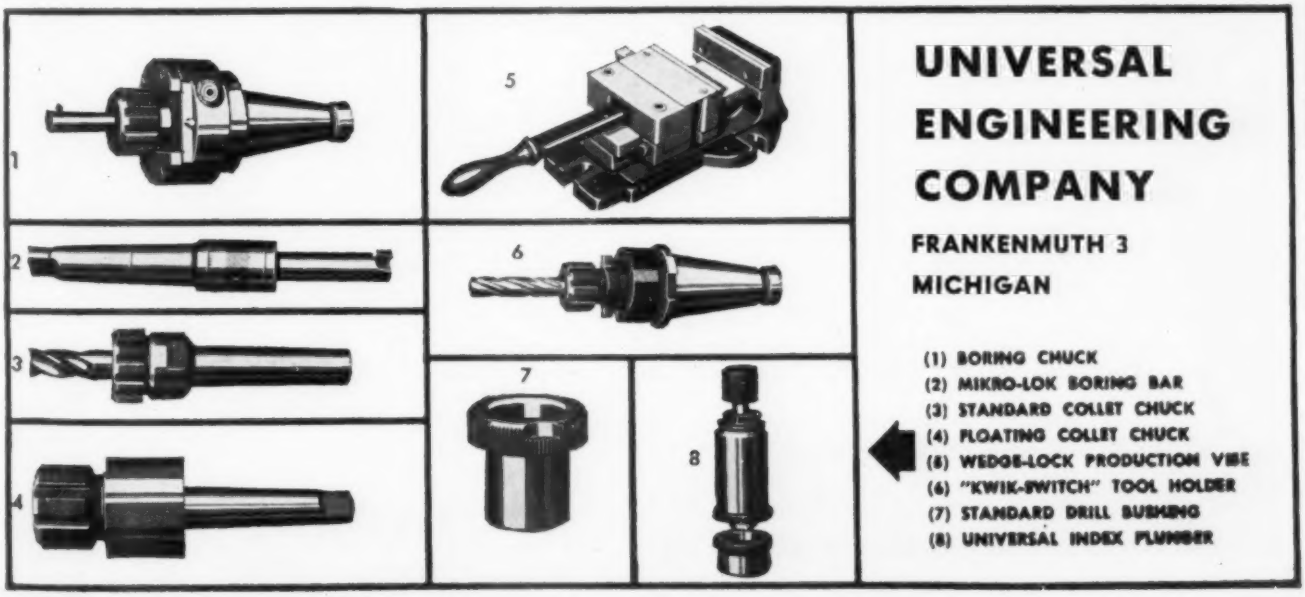
SUPER FINISH OF UNIVERSAL DRILL BUSHINGS . . .



. . . reduces tool wear to a minimum

One sure way to cut excessive tool wear in your operations is to specify Universal Drill Bushings because their superfinish bores help reduce wear on production tools to an absolute minimum, especially in close tolerance work. The blended radius on the top inside diameter helps prevent tool hang-up and breakage. 100% concentricity and hardness tests insure accuracy, uniform high quality and long life. Knurled heads provide a quick, sure grip. Universal Drill Bushings are produced in a complete range of standard sizes and lengths. Orders for special dimensions will receive prompt attention. For complete information, write to the office nearest you—Universal Engineering Sales Co., 1060 Broad St., Newark 2, N.J.; 5035 Sixth Ave., Kenosha, Wis.—or our home office.

170



UNIVERSAL ENGINEERING COMPANY

FRANKENMUTH 3

MICHIGAN

(1) BORING CHUCK
(2) MIKRO-LOK BORING BAR
(3) STANDARD COLLET CHUCK
(4) FLOATING COLLET CHUCK
(5) WEDGE-LOCK PRODUCTION VISE
(6) "KWIK-SWITCH" TOOL HOLDER
(7) STANDARD DRILL BUSHING
(8) UNIVERSAL INDEX PLUNGER

HARTFORD *Special*

UNIVERSAL DRILLING MACHINE

- *Fully Automatic*
- *Highly Accurate*
- *Completely Flexible*
- *Quickly Converted*
- *Wide Job Range*

Write now for Bulletin UM-100 with complete information & specifica

This design provides a basic machine employing standardized component assemblies with utmost versatility. It enables the user to create his own single purpose machine to keep pace with engineering changes and obsolescence of parts. Yet it requires only one original investment.

QUICK SPECS:

1. Handles 8" to 60" diameter bolt circles.
2. Accommodates up to four drilling or tapping units.
3. Has 16 spindle speeds from 180 to 6700 RPM.
4. Interchangeable index plates for equal or unequal hole patterns.
5. Has ½" capacity in stainless steel.
6. Units quickly adjustable radially, vertically and circumferentially.

The Hartford Special Machinery Co.
Hartford 12, Conn.

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National Tool Co.

Years of successful experience in special tooling and related manufacturing problems are yours for the asking. When you require special cutting tools call in your National Tool Co. representative. He is backed by many years experience in the engineering and manufacture of special cutting tools. His assistance is yours without obligation, whether your interest is in one tool or a complete tooling program.

National Tools

National
TOOL CO.
Cleveland 2, Ohio

Wiedemann Turret Punch Presses

Pay Off **IN TWO YEARS OR LESS . . .**

(4000 hours of operation)

precision-pierced parts of these and similar products are produced in small lots with low tooling cost

WITHOUT LAYOUT—WITHOUT SET-UP

A WIEDEMANN PIERCES SMALL LOTS COMPLETE, IN LESS TIME THAN LAYOUT BY CONVENTIONAL METHODS

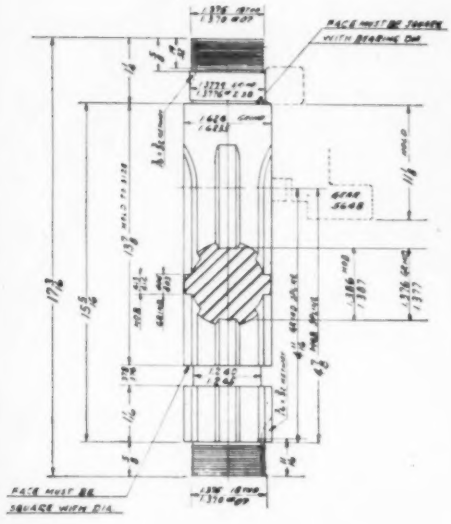
We'll gladly make a time study on your work.

WIEDEMANN MACHINE COMPANY

here's FACTUAL EVIDENCE from TIME SHEETS OF THE FOSDICK MACHINE TOOL CO. CINCINNATI

EXAMPLE No. 1

TURNING SHAFT—BACK GEAR



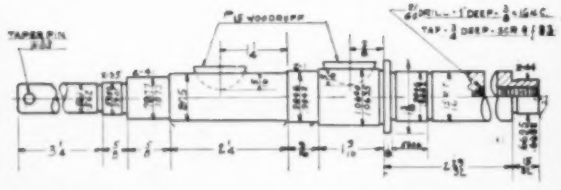
Old lathe time..... 28 minutes per piece

Sidney Lathe Time..... 18 minutes per piece

TIME SAVED 10 MINUTES PER PIECE

EXAMPLE No. 2

TURNING SPRING DRUM SHAFT



Old lathe time..... 90 minutes each

Sidney Lathe Time..... 30 minutes each

TIME SAVED..... 60 MINUTES EACH

SIDNEY FLUID TRACER LATHES

CUT WORK TIME TO FRACTIONS

TIME COSTS MONEY . . . SAVE TIME AND MONEY WITH SIDNEY TRACER LATHES . . .

the tracer imparts all impulses to the various operating units as it follows along a template or master piece. These units function automatically to reproduce the work in any quantity . . . the more work produced, the more time and money saved.

Write for bulletins

THE SIDNEY MACHINE TOOL CO. • SIDNEY, OHIO

Builders of Precision Machinery since 1904

Control

Bath engineers check every detail, to see that all Bath Taps are conditioned to do the best threading job for your requirements.

Supremacy in manufacture of Bath Taps, depends on vigilance during every step of production. Again . . . a matter of perfect control!

It begins with careful laboratory tests of basic materials . . . and continues with rigid check-ups on machine function and routine inspections for accurate measure . . . to meet the high performance standards set for Bath regular and custom-built ground thread taps.

Quality control is a matter of habit at the Bath plant . . . it's the reason you can depend on uniformity and exact duplication, every time you re-order.

Remember . . . Bath engineers are experienced in "tap-ology" . . . they'll be glad to help you maintain control over threading costs, by proper tap selection.

Insist on BATH TAPS for BETTER THREADS

JOHN BATH & CO., Inc.

28 Grafton St., Worcester, Mass.

PLUG AND RING THREAD GAGES • GROUND THREAD TAPS • INTERNAL MICROMETERS

Here's your guide to NEW SAVINGS with NEW Standardized BOSTON Gear Products — from STOCK

NEW

Certified
BEAR-N-BRONZ Solid Bronze Bearings

A complete line — 768 stock sizes of Standard Bearings — 221 stock sizes of Cored Bars — 35 stock sizes of Solid Bars. CERTIFIED Highest Quality, with a MONEY-BACK offer.

NEW

SPROCKETS Larger, heavy duty SHOLD-A-GRIP Interchangeable Tapered Sprockets and Bushings

Sprockets up to 24" pitch dia. — and Bushings to fit shaft sizes from ½" to 3" by 16ths. Also, more sizes available in conventional sprockets.

NEW

BOST-BRONZ BEARING BANK

A sturdy metal kit, with 47 common sizes of Bost-Bronz oil-impregnated bearings, from which 313 standard sizes can be cut with a hacksaw — means you have any bearing you need on *hand* in any emergency. Saves 50% over buying same bearings separately.

20 SHAFT SIZES UP TO 2 7/16"

NEW

PILLOW BLOCKS and Flanged Cartridges in larger sizes

ADDED TO FORMER ½" TO 1¼" RANGE

Now, precision Type ABEC No. 1 Classification Bearings in a stock size range for 27 shaft sizes from ½" to 2 7/16", fully self-aligning.

NEW

20° PRESSURE ANGLE SPUR GEARS in a full range of stock sizes

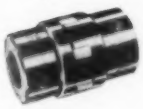
Off-the-shelf delivery on 20 pitch to 4 pitch with pitch diameters from .6" to 40". Save 20% in weight — space — cost.

NEW PRODUCTS Catalog NP-55

lists full specifications of these new Boston Gear products and many others in 196 pages. Get your copy . . . use it with your BOSTON Gear General Catalog No. 55 . . . for up-to-the-minute information on the products that make BOSTON Gear first choice of cost-wise buyers.

NEW

3-PIECE JAW COUPLING with BOST-BRONZ insert

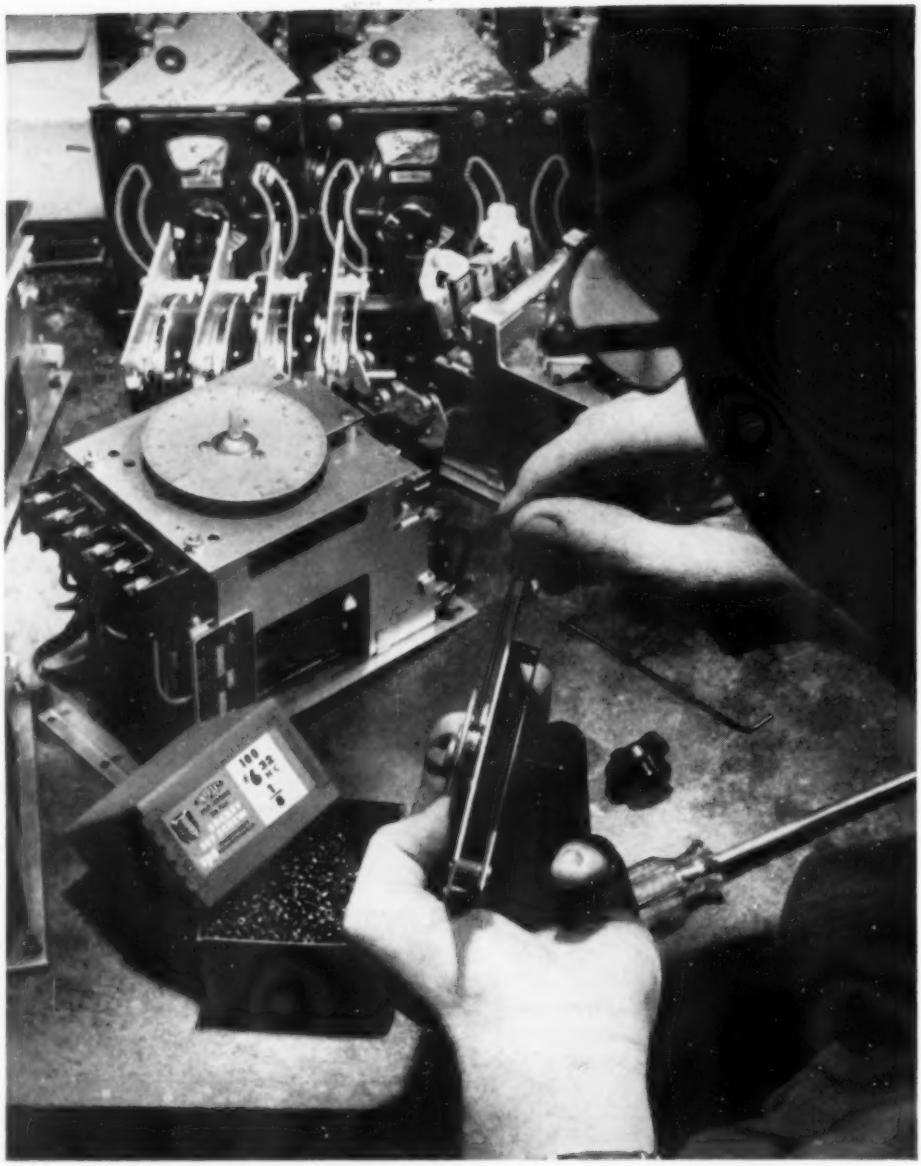


BOST-BRONZ oil-impregnated Bearing cushions torsional load, resists wear from any rubbing friction . . . 17 stock sizes, with hole diameters from 3/8" to 1½".

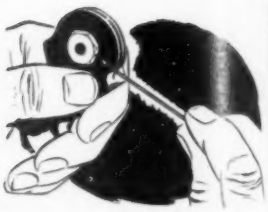
Get your copy from your nearby

BOSTON Gear® DISTRIBUTOR

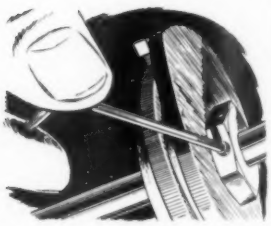
Look under "Gears" in the Yellow Classified Section of your Telephone Directory for the BOSTON Gear Distributor nearest you. Catalog NP-55 also available from Boston Gear Works, 83 Hayward St., Quincy 71, Mass.



UNBRAKO **Self-Locking Socket Set Screws** are used to hold the Vernier-Set or Cycle-Progress cam on the shaft of this precision timing device. Once they are tightened, they maintain the accurate setting so important to the operation of the instrument.



Because they are so tiny, the UNBRAKO set screws are picked up and started in the tapped hole with the long arm key.



The compactness of the design of the timing device makes it necessary to turn the screw in prior to assembly. The uniform depth and size of the hex socket permit maximum torquing, speed assembly.

UNBRAKOS—made of heat treated alloy steel—have fully formed threads, Class 3 fit; have knurled cup point for positive locking. Are available in standard sizes from #4 to 1".

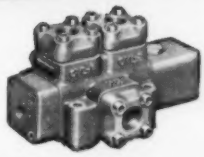
You can lower your inventory by using UNBRAKO Standards—stocked by your distributor

You'll have less money tied up in inventory, you'll get personalized service, faster deliveries. In addition, you'll reduce assembly time and increase production with these precision industrial threaded fasteners. Write for UNBRAKO Standards—a complete listing of socket screw products made by SPS and stocked by your local distributor. STANDARD PRESSED STEEL CO., Jenkintown 37, Pa.

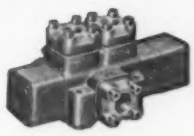
UNBRAKO® **SOCKET SCREW DIVISION** SPS JENKINTOWN PENNSYLVANIA

A REALISTIC APPROACH TO THE AUTOMATION TREND

SOLENOID OPERATED DIRECTIONAL VALVES



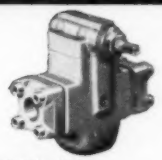
PILOT OPERATED DIRECTIONAL VALVES



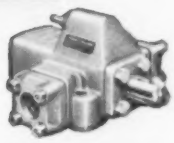
AIR PILOT OPERATED DIRECTIONAL VALVES

CONTROL VALVES

CAM OPERATED DIRECTIONAL VALVES

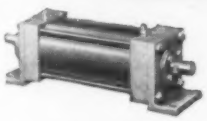


RELIEF AND SEQUENCE VALVES

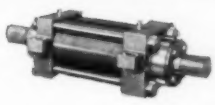


CAM OPERATED FLOW CONTROLS

DOUBLE ACTING CYLINDERS



FOOT MOUNTED CYLINDERS



CENTERLINE MOUNTED CYLINDERS

CLEVIS MOUNTED CYLINDERS

CONSTANT AND VARIABLE VOLUME PUMPS

CONSTANT VOLUME HYDRAULIC PUMPS

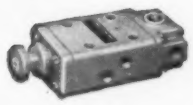
VARIABLE VOLUME HYDRAULIC PUMPS

VARIABLE VOLUME WITH CIRCULATING PUMP

POWER UNITS AND ACCESSORIES

SINGLE AND DOUBLE PUMP POWER UNITS

PILOT OPERATED CHECK VALVES



PRESSURE SWITCHES

Consider hydraulics for the power and control of your automatic equipment and rely on H-P-M as your best source for hydraulic components. Our complete line of cylinders, valves and power equipment will simplify your planning; our engineering staff and field representatives provide a background of experience that helps solve problems.

The hydraulic components illustrated are only part of the wide selection of standard hydraulic equipment available from H-P-M. Whether your automatic cycle involves mechanical, electrical, hydraulic, air or pressure control sequencing, you'll find the right equipment in the H-P-M line.

In addition to the equipment shown, H-P-M manufactures a complete line of lever and mechanically operated valves and controls. Write for complete information today.

Send for this completely illustrated, condensed catalog of the H-P-M line of hydraulic components. No obligation, of course.

HPM

HYDRAULIC POWER DIVISION

THE HYDRAULIC PRESS MFG. CO.

MOUNT GILEAD, OHIO, U. S. A.

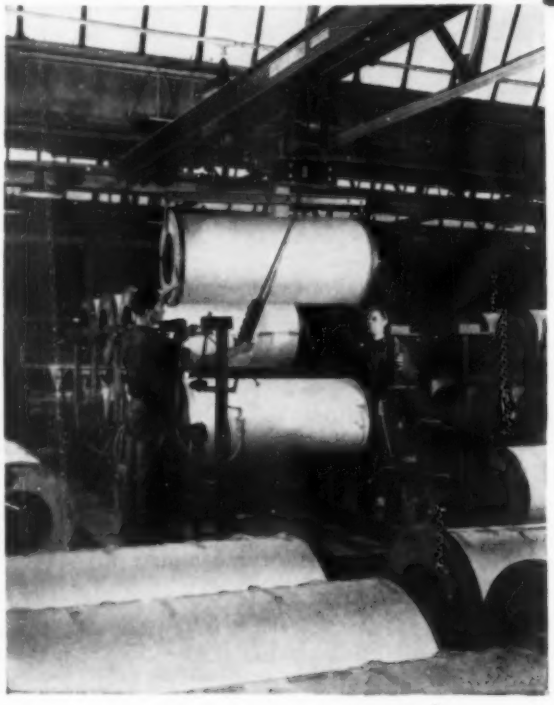
2004 Marion Road

USE MONORAIL CRANES

. . . Where Space is Limited

. . . To Handle Variable Jobs

. . . For Low Maintenance Cost



These are just a few reasons why American MonoRail Cranes are gaining in popularity and are being installed in increasing numbers of plants the country over. Call in your American MonoRail representative and have him tell you all the advantages of MonoRail Cranes such as—ease of handling—smooth travel—strength—safety interlocks—power operation and **interlocking carrier service between and beyond the craneways.** Consultation in connection with any handling problem is available without obligation.

Send for your copy of C-1 Bulletin

AMERICAN OVERHEAD HANDLING EQUIPMENT

MONORAIL COMPANY

13133 ATHENS AVENUE • CLEVELAND 7, OHIO

TAPS *by* CARD

Whether its high precision on mass production or on special manufacturing lines, the extra value Card builds into its taps always pays off in performance.

The CARD Quality

Completely stocked offices at Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York, San Francisco and Seattle

See your local Card distributor for prompt deliveries and helpful service

S. W. CARD MANUFACTURING CO., MANSFIELD, MASS. • DIVISION OF UNION TWIST DRILL CO. • TAPS • DIES • SCREW PLATES

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-9-231

Once again!...

Jacobs doubles

production rate—

grinds 100% faster

Leading chuck manufacturer uses Norton machines to cut grinding time in half

When a leader like The Jacobs Manufacturing Company selects equipment, you can be sure that this equipment has had careful study from every angle of performance and cost.

That's why Jacobs' choice of Norton grinding machines is worth serious consideration when *you* are buying grinding machines.

In producing their famous Rubber-Flex Collets, for example, Jacobs reports that switching from separate operations to a single operation on Norton Type CTU Semiautomatics with multi-wheel mounts has doubled their production rate. *Jacobs reported similar production savings in grinding chuck bodies on the same type of Norton machines.*

Another manufacturer has boosted production from 300 to 600 parts per hour by grinding 2 diameters at once on a Norton machine. Still another reports that a Norton grinding machine with a triple-wheel mount has upped his production rate 128%. Throughout industry, manufacturers are using Norton grinders and lappers to save time, work and money in grinding operations.

Norton Machines in Your Own Grinding bring the same profit-increasing advantages. And remember: only Norton offers you such long experience in both grinding wheels and machines to help you produce more at lower cost.

For further facts, see your Norton Representative, or write us direct. NORTON COMPANY, Machine Division, Worcester 6, Mass. *In Canada:* J. H. Ryder Machinery Co., Ltd., Toronto 5.

To Economize, Modernize With NEW

NORTON

GRINDERS and LAPPERS

Making better products... to make other products better

District Sales Offices: West Hartford • New York (Teterboro, N. J.) • Cleveland • Chicago • Detroit

In the Jacobs Plant. One of the Norton 6″ Type CTU Semiautomatic Grinding Machines used by The Jacobs Manufacturing Company of West Hartford, Connecticut, to grind metal inserts in the famous Rubber-Flex Collets. The basically fast action of this Norton grinder, the multi-wheel mount, special swivel table arrangement and wheel-truing device provide a single setup for traverse and shoulder grinding operations that boosts production rate 100%.

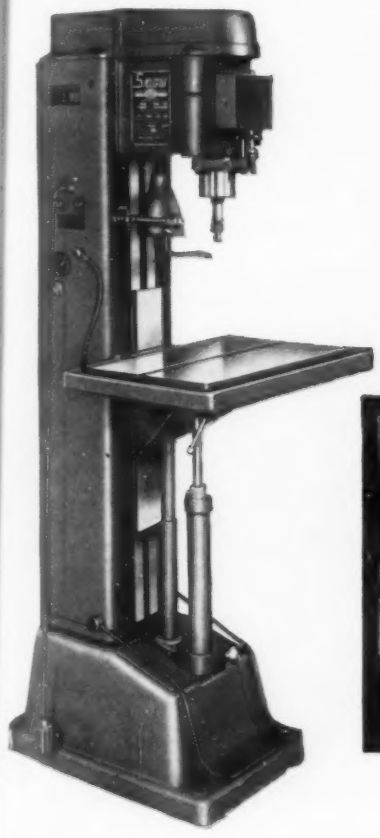
Quicker changeover, lower tooling costs...

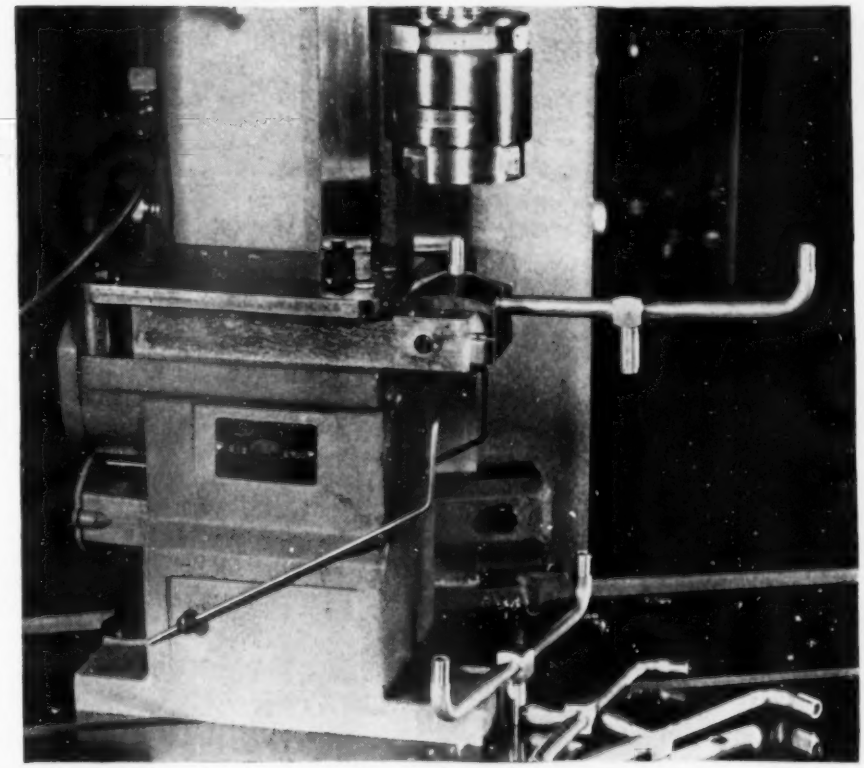
with SNOW FULL UNIVERSAL MACHINES

ELECTRICALLY OPERATED
AIR CONTROLLED
AUTOMATIC OR
SEMI-AUTOMATIC

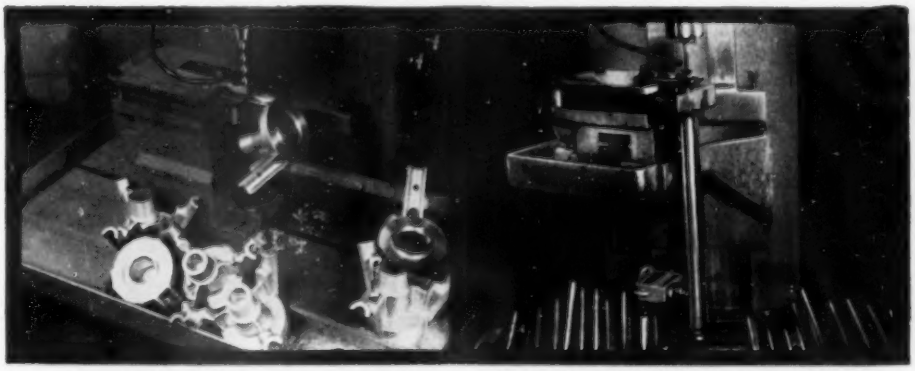
Basic Master Fixtures for DRILLING, THREADING or TAPPING. Snow universal machines are the most flexible, most efficient, and most economical known. They save countless dollars in changeover time — help you start jobs sooner — assure quality at high production rates.

The square footage under a Snow Machine in your factory can be the most profitable in your whole plant. Submit details of your requirements.





AIR VISE holds part firmly — self-centering — always in exact position for precision work. U-shaped wire underneath provides quick finger-tip control, automatically starting spindle cycle. Jaw inserts keep tooling costs at minimum. Blank jaws always in stock — can be tooled to fit your part promptly, inexpensively.

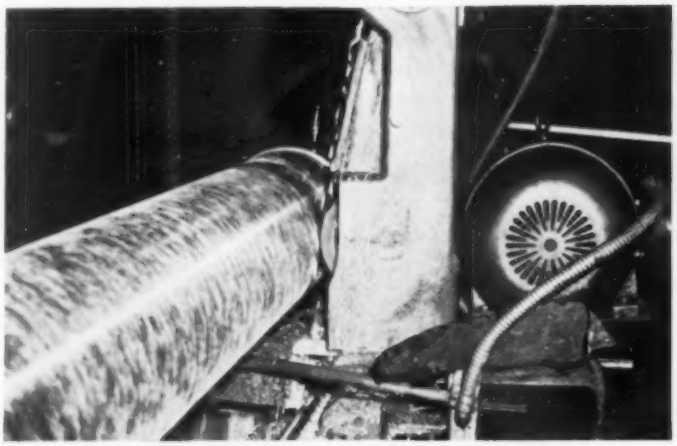


Irregularly shaped parts are easily handled. Front feed permits close setting of guide plate for greater accuracy with high production.

Here a short AIR VISE mounted on an offset table holds long tubing. Piece-part switch under table automatically closes vise and starts tapping operation.

SNOW MANUFACTURING CO., BELLWOOD, ILL.
(Suburb of Chicago)

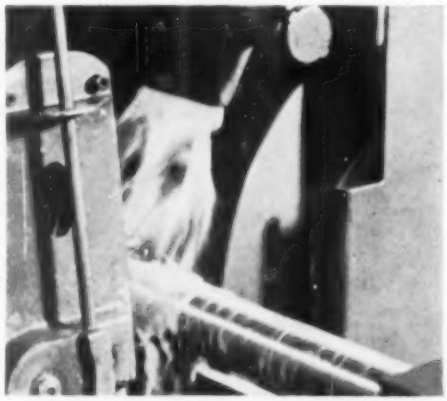
Today's fastest-movin



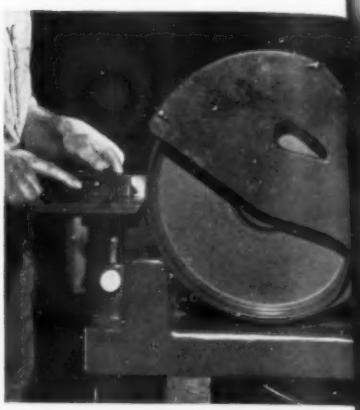
Finishing steel pistons with a wet belt sander which traverses the length of the cylinder.

Removing flash from inside with METALITE Cloth Belt.

Some of these recent applications are giving production a big lift

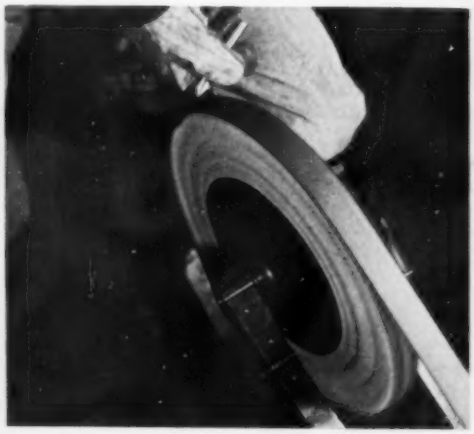


Centerless polishing of cylindrical work with BEHR-MANNING METALITE Belt.



Sharpening carbide tools with BEHR-MANNING Micro-Finish DURITE® Paper Belt.

Polishing narrow recess in die, with METALITE Cloth SPIRABAND® on portable tool.



Polishing the concave section of a golf club with a flexible belt and buff-type wheel.

METALITE® Cloth Belt removing casting edges and deburrs on metal statues.

For the newest in coated abrasive

roduction tool...

BEHR-MANNING® Coated Abrasives

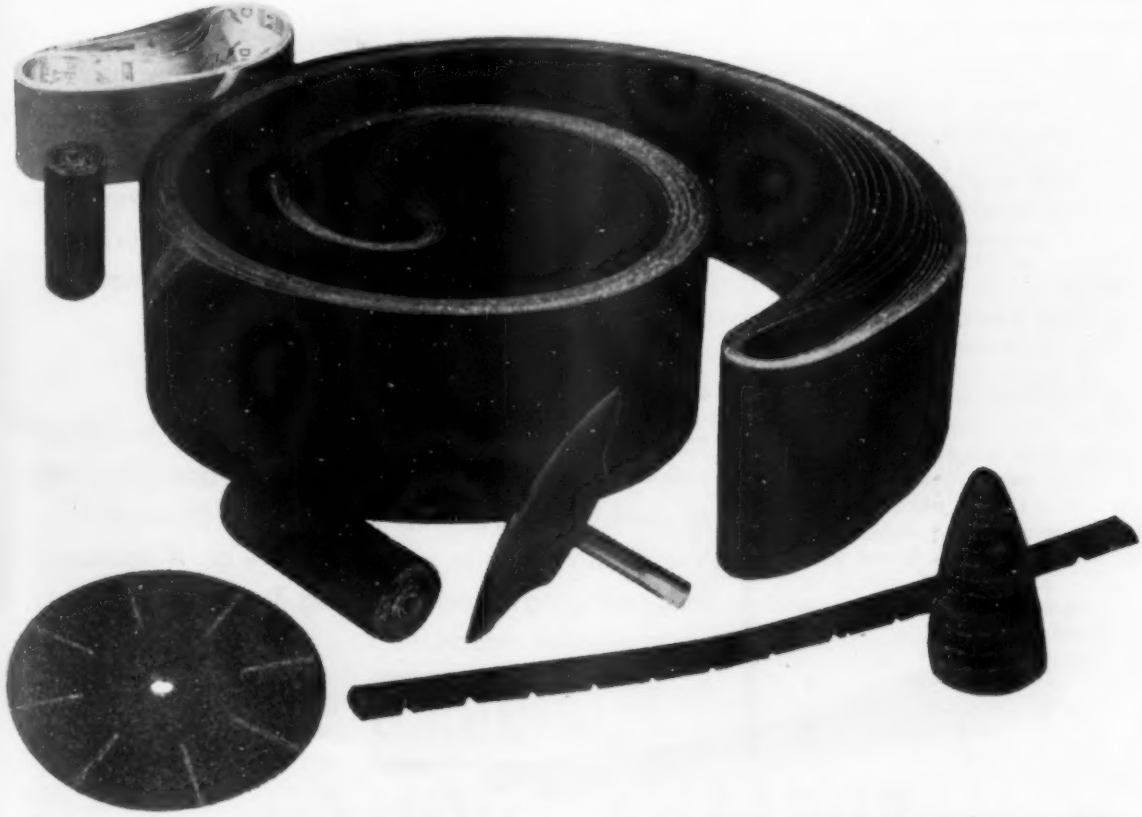
By leaps and bounds, this high potential productive tool of the metalworking industry has become a major factor in industry today. Methods that yesterday were experimental, have quickly demonstrated their value, and now standard machinery is manufactured to make widespread application possible.

The latest mechanized methods of applying coated abrasives in a more productive way, are represented in BEHR-MANNING Demonstration Rooms, strategically located over the country. Visit the one near you—see the latest time-saving equipment—try it out on your work—and find new ways to cut costs. No obligation—just 'phone your local BEHR-MANNING Representative or write Behr-Manning Corp., Troy, N. Y., Dept. TE-9.

In Canada: Behr-Manning (Canada) Ltd., Brantford. For Export: Norton Behr-Manning Overseas Inc., New Rochelle, N. Y., U. S. A.

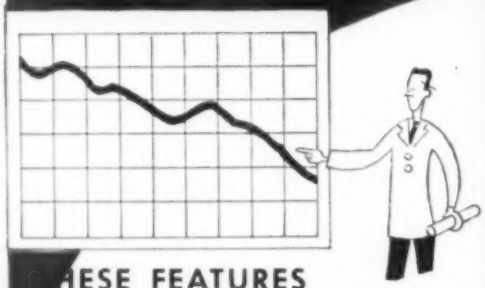
BEHR-MANNING® CORPORATION
division of NORTON Company

▲ COATED ABRASIVES
▲ SHARPENING STONES
▲ PRESSURE-SENSITIVE TAPES



watch BEHR-MANNING!

Blade Spade Drills — ...6" diameter in stock sizes. ...lasts indefinitely, only blades ...be replaced.



Cut Tooling Costs

with WAUKESHA Standard Cutting Tools...

Adjustable Blade Reamers — Inserted Blade Spade Drills — and other Standard Cutting Tools by Waukesha — are saving thousands of dollars in tooling costs, in all types of reaming, drilling and boring operations. Their versatility and adaptability eliminate substantial investments in special tools — and their inherent features result in operating and maintenance economies which you cannot afford to overlook.

consult WAUKESHA

— for Competent Cutting Tool Counsel. Waukesha sales representatives and engineers are qualified to work with your staff in adapting Standard Waukesha Tools to your needs — or, if necessary, in developing Special Cutting Tools for your unusual needs.

Representatives in Principal Cities

...HESE FEATURES ...f Standard WAUKESHA Inserted-Blade Cutting Tools Save You Money —

Replaceable Blades — Cost only a fraction of the price of a solid tool, assure long term economy.

Interchangeability — Each size of Waukesha Spade Drill Holder takes a ½" range of sizes in spade blades, except in the smaller sizes which cover only a ¼" size range.

Shear-Cutting Action — Waukesha Blades have a "knife-slice" cutting action that curls chips away from stock, prevents scoring, assures free cutting, requires less power.

More Grinds per Blade — More Holes per Grind
Waukesha Blades can be advanced and re-ground before discarding — yielding a substantial saving over High Speed Solid Steel Tools — and the high quality of Waukesha Blade Stock assures More Holes per Grind.

A-8014-11-C

check with the standard

... and with high speed steels the standard is REX

It's easy to check on Junior's vision these days with *standard* eye charts. And for half a century there's been a *standard* in tool steels, too — Crucible REX® High Speed Steel.

Try REX High Speed Steel in your own shop as thousands all over the world have done. Use it under the toughest conditions . . . compare its performance with all other high speed steels. You'll find that *absolutely nothing beats REX.*

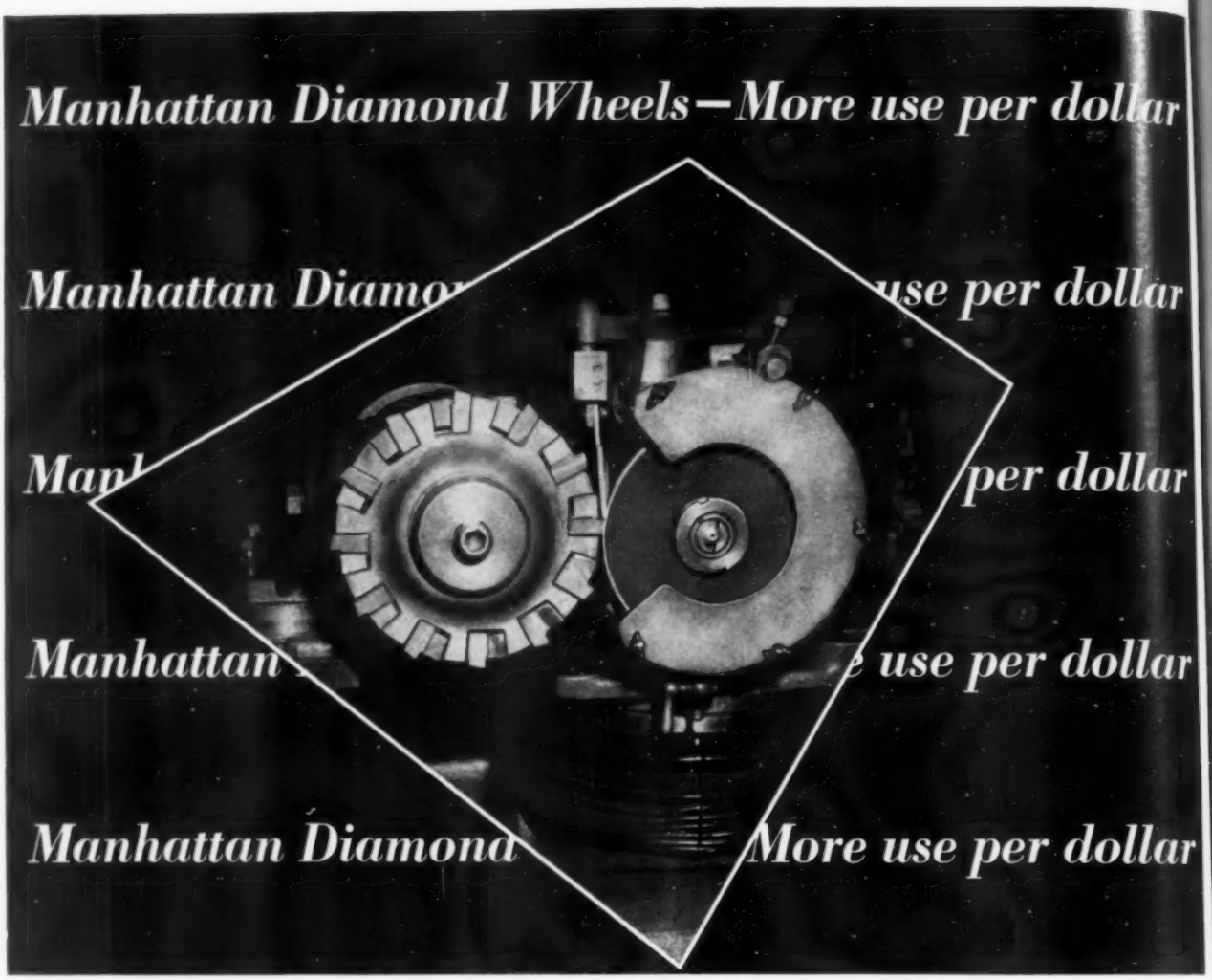
That's because REX High Speed Steels are unsurpassed in structure, finish, carbide distribution, response to heat treatment and general uniformity. So, on your next purchase of high speed steel, specify REX — made only by Crucible.

CRUCIBLE first name in special purpose steels

54 years of Fine steelmaking **TOOL STEELS**

CRUCIBLE STEEL COMPANY OF AMERICA · TOOL STEEL SALES · SYRACUSE, N. Y.

Canadian Distributor — Railway & Power Engineering Corp., Ltd.



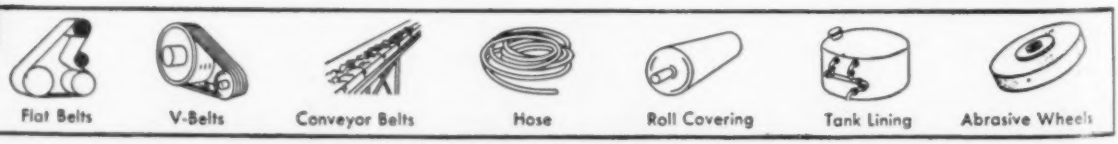
FOR ECONOMY AND PRECISION . . . specify Manhattan Diamond Wheels . . . and see why Manhattan leads the field. For all tungsten carbide grinding . . . for quartz, synthetic sapphire and glass . . . for internal, surface, and cylindrical operations, Manhattan Diamond Wheels give you the fastest, coolest cutting. One reason — Manhattan's special resin bond which resists loading or glazing when grinding carbide tipped tools on soft or hardened steel shanks.

When you specify Manhattan Diamond Wheels, you are buying More Use per Dollar . . . lowering costs . . . building profit.

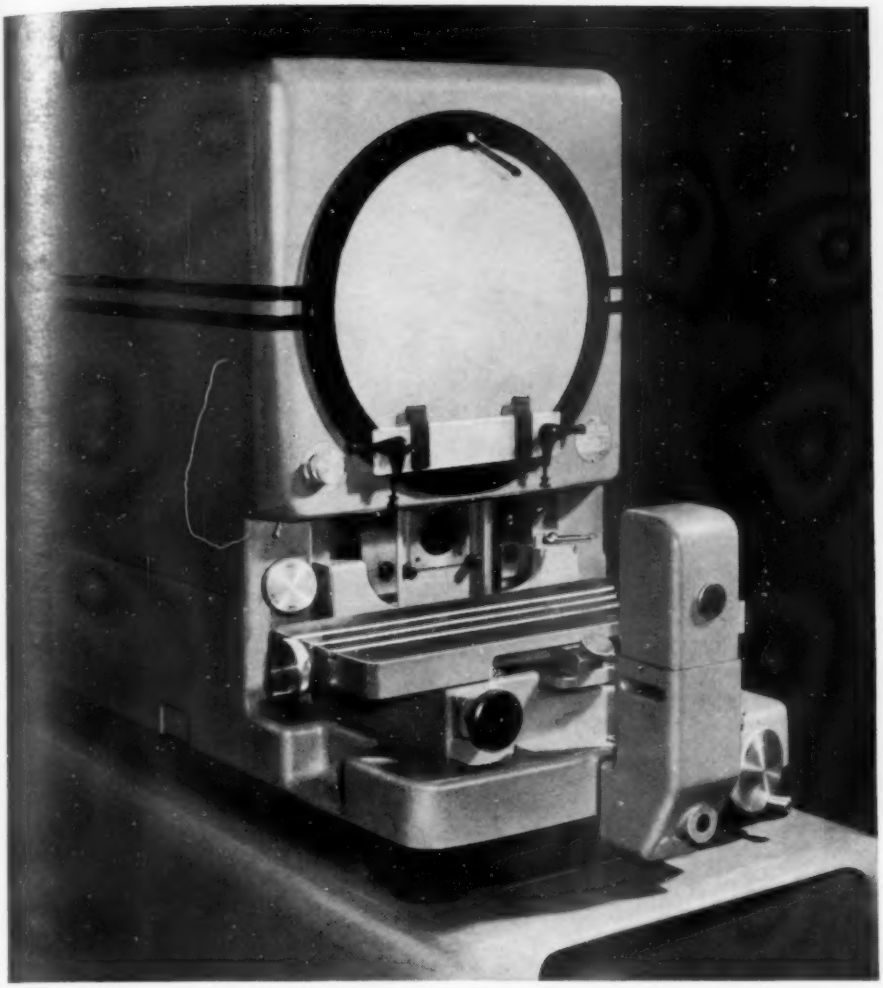
WRITE TO DIAMOND WHEEL DEPARTMENT

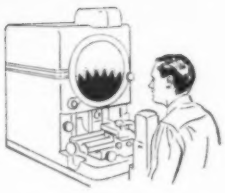
MANHATTAN RUBBER DIVISION — PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.



Other R/M products include: Industrial Rubber • Fan Belts • Radiator Hose • Brake Linings • Brake Blocks • Clutch Facings Asbestos Textiles • Teflon Products • Packings • Sintered Metal Parts • Bowling Balls





For maximum versatility in production inspection...

the NEW KODAK CONTOUR PROJECTOR, Model 4

You'll find setups are faster, fixturing easier when you use the Kodak Contour Projector, Model 4, for routine gaging of precision parts.

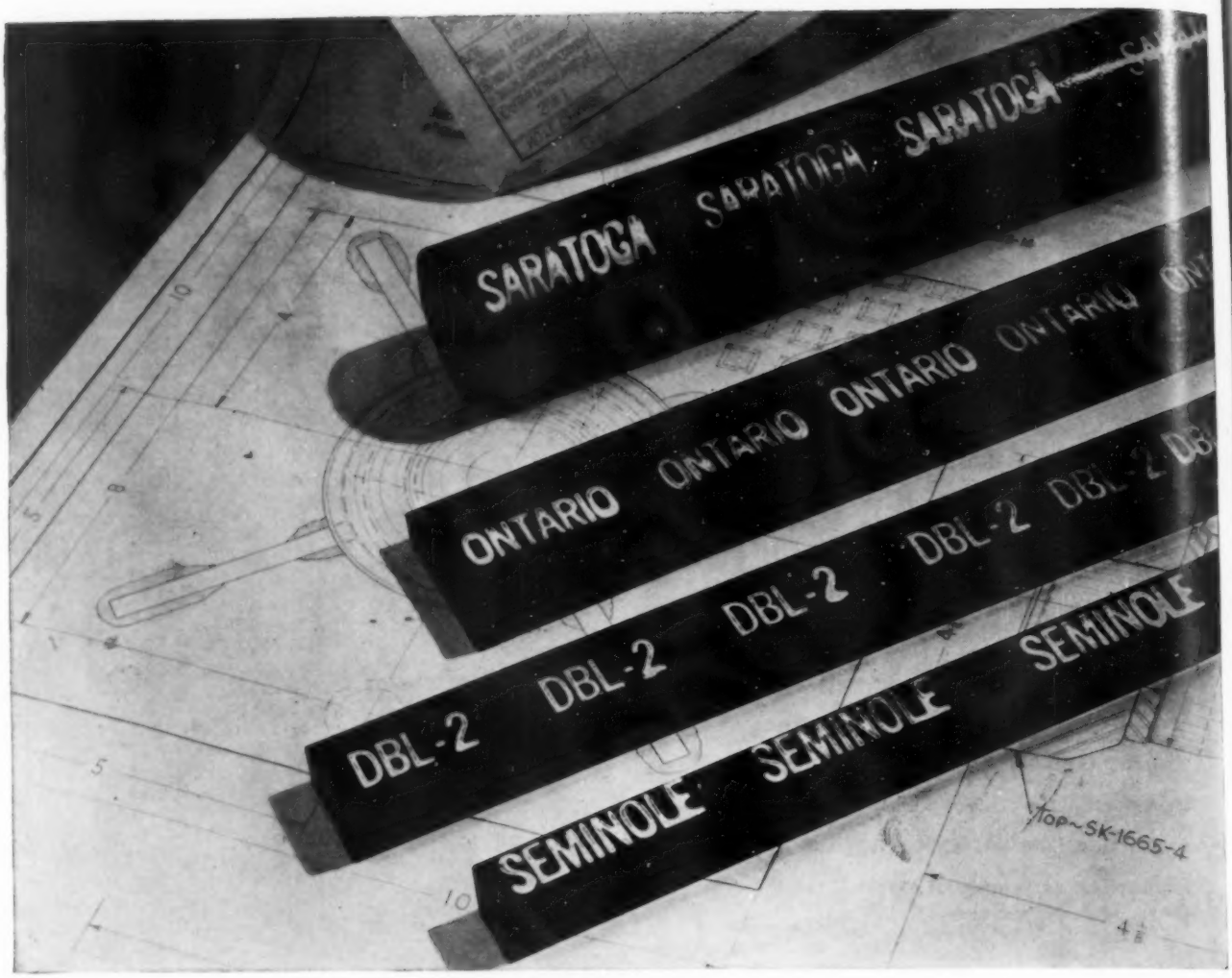
Designed for use on the inspection line, it has a movable table with 4 inches of travel in both horizontal and vertical directions. This lets you handle a wide variety of parts with simple fixturing.

The Kodak Contour Projector, Model 4, has the same unique optical system as the famous Kodak Contour Projectors, Models 2A and 3. The 14-inch viewing screen covers a field of 1.4″ at 10× magnification. Vertical illuminator, surface illumination, six-power lens turret, and rotating screen with protractor ring are available as accessories. For complete details, write to:

EASTMAN KODAK COMPANY
Special Products Sales Division
Rochester 4, N.Y.

the KODAK CONTOUR PROJECTOR

Kodak
TRADE MARK



LUDLUM TOOL STEELS are *clearly* marked ...you can't mix up grades in your stock

For Production Men Only

"TOOL STEEL HANDBOOK"

We say "production men only" because this is a *work* book, not a picture book. It's a case-bound volume of 196 pages, packed full of technical data on the analyses, uses, handling and shop treatment of all grades of A-L Tool and Die Steels. Sent free, but ask for it on your company letterhead, please.

Address Dept. TE-57

"What's *that* piece?" . . . "Are you *sure?*" . . . In anybody's toolroom or stock racks, the best inventory or material identification system is apt to go haywire once in a while—and sometimes with grievous results.

But not when you're using tool steel grades produced by A-L! Each length of Ludlum Tool Steel is clearly marked with its grade name every few inches the entire length of the bar—*stencilled* in such a manner that the marking stays bright and clear, and can't be blurred or wiped off in handling.

Even a small crop end on a machine bench is readily identifiable—you can't go wrong. And that's only a small part of the benefit you can realize by using Ludlum Tool Steels—available from stocks coast to coast. Let our Metallurgical Service go to bat on some of your tougher tool steel problems. ***Allegheny Ludlum Steel Corporation, Oliver Bldg., Pittsburgh 22, Pa.***

For complete **MODERN** Tooling, call

Allegheny Ludlum

WAD 5221

AL® FINE TOOL STEELS SINCE 1854

this low-cost carbide-tipped reamer that holds precision tolerances in mass production!

Exceptional tool savings are made possible by this Staples Carbide-Tipped Shell Type Expansion Reamer (patented). These savings are fully realized in the plant of a leading midwest truck engine manufacturer. When the carbide-tipped shell has worn to the tolerance limit, it is quickly, accurately expanded to original diameter by driving the shell up the tapered arbor.

In the application cited at left, the tool shown above reamed 3591 cylinder blocks before requiring sharpening. The tool was resharpened 16 times and expanded as required to hold tolerance, before it was worn undersize. Note the hole finish obtained. The tool was then returned to new condition simply by replacing only the shell—an inexpensive stock item. Where hole tolerances are not as close and finish requirements not as critical, the number of pieces reamed before expansion would greatly increase.

If you are seeking relief from high tool costs on a precision, mass-production reaming job, this Staples Reamer is your answer! Staples engineers will gladly work with you on the application. Your inquiry will bring a prompt response.

3591 CYLINDER BLOCKS REAMED PER SHARPENING—TOOL RESHARPENED 16 TIMES

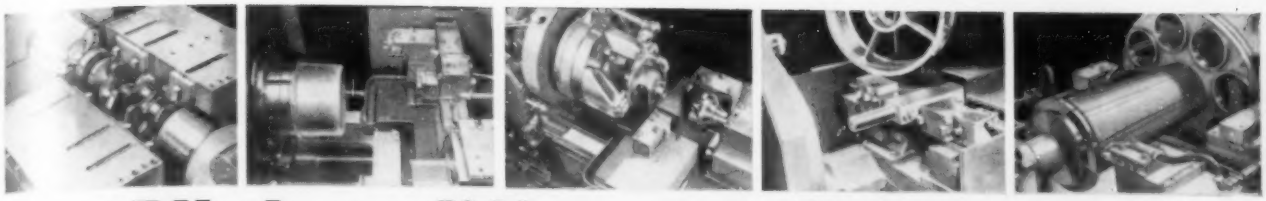
JOB DATA:

Machine	Multiple spindle drill station in automatic transfer machine
Work	Finish ream tappet bores in cast iron cylinder blocks
Hole Diameter	1"
Hole Depth	2"
Stock Removal	0.015"
Tolerance Held	+.0002" —.0002"
Finish Specified	40 RMS minimum
Finish Obtained	10 to 20 RMS
Spindle Speed	416 RPM
Feed Rate	.0149" per Rev.

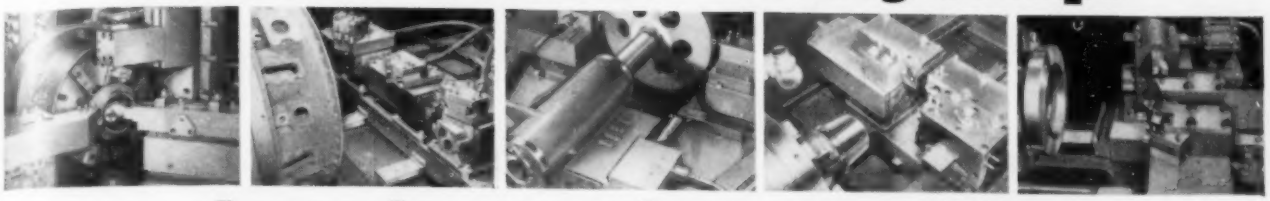
Staples CARBIDE-TIPPED CUTTING TOOLS

A complete line of Circular Carbide-Tipped Tools, Expansion Reamers—Special Tools

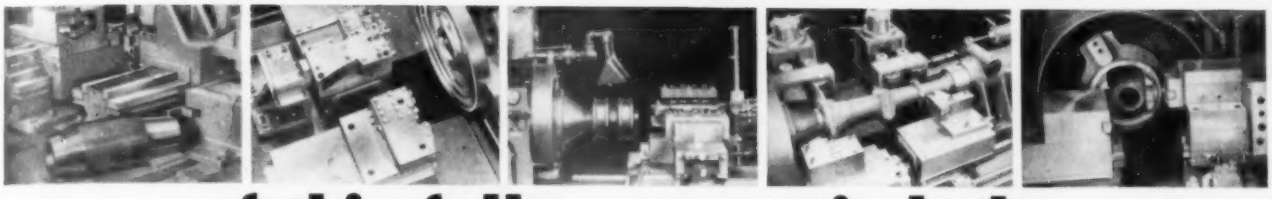
THE STAPLES TOOL COMPANY, Cincinnati 25, Ohio



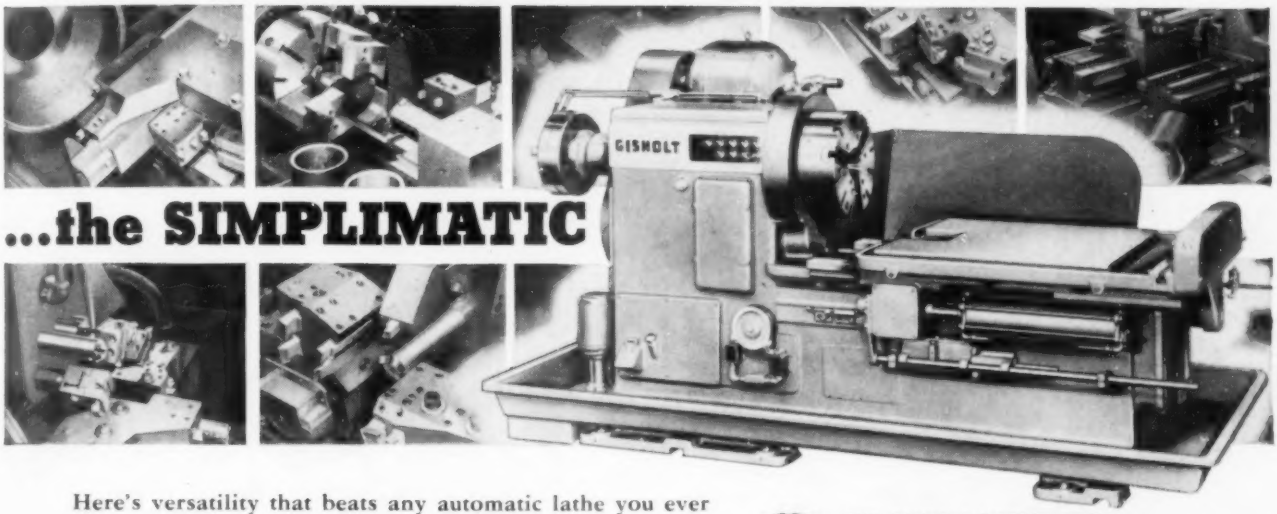
All these different tooling setups



show the amazing versatility



# of this fully automatic lathe



...the SIMPLIMATIC

Here's versatility that beats any automatic lathe you ever saw! Actually, the Simplimatic is doing hundreds of jobs like these—jobs that would otherwise be put on *special* machines—built at extra-special cost. But this (and don't miss the important point!) is a *standard machine*—at a *standard price.*

If you have medium or long runs on parts up to 33½" in diameter, get the facts about the Simplimatic Automatic Lathe.

GISHOLT
MACHINE COMPANY
Madison 10, Wisconsin

TURRET LATHES • AUTOMATIC LATHES
SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

THE GISHOLT ROUND TABLE
represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

THIS CATALOG may show you how the Simplimatic can save thousands of dollars for you as it is doing for many others. Write for your copy.

Gisholt Machine Co.
Madison 10, Wisconsin
Gentlemen:
Please send my copy of the Simplimatic Catalog.

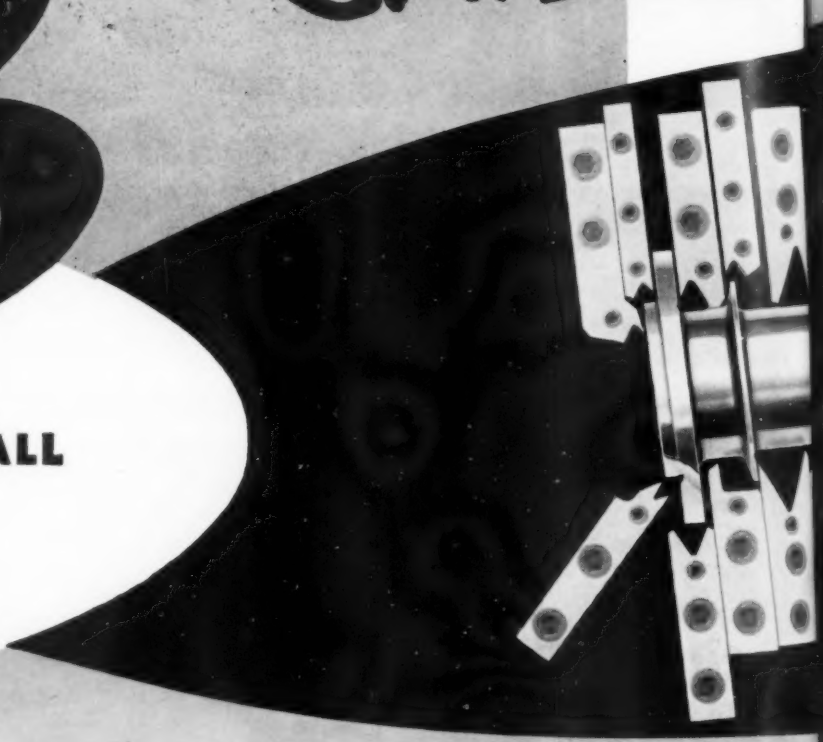
Name.....*Title*.....
Company.....
Address.....
City.....*Zone*....*State*.....

WESSONMETAL
Carbide Blanks

WESSON
Carbide Cutting Tools
ENGINEERED FOR CARBIDE

WICKES

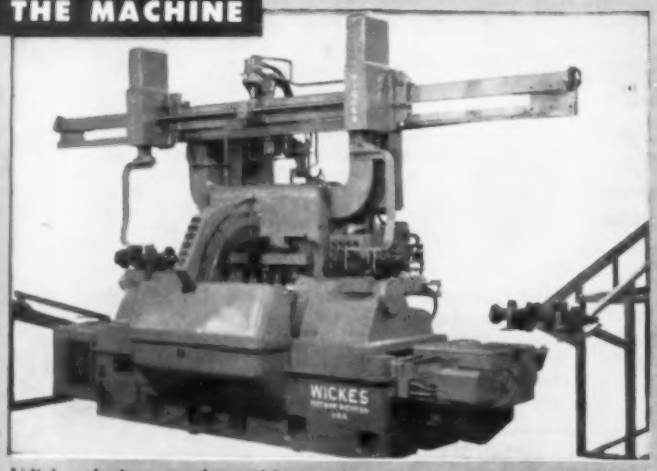
COMBINED SKILLS



WORKING TOGETHER FOR THE BENEFIT OF ALL TO CREATE . . .

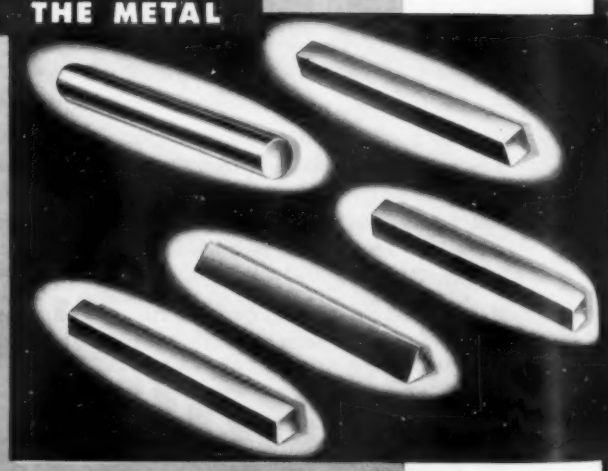
- More Productive Tools
- More Productive Machine Tools
- More Uniform Quality Carbide
- Lower Costs

THE MACHINE



Wickes lathes used on this tough operation are the result of engineering-design experience gained from many years of solving hundreds of specific machine tool problems.

THE METAL

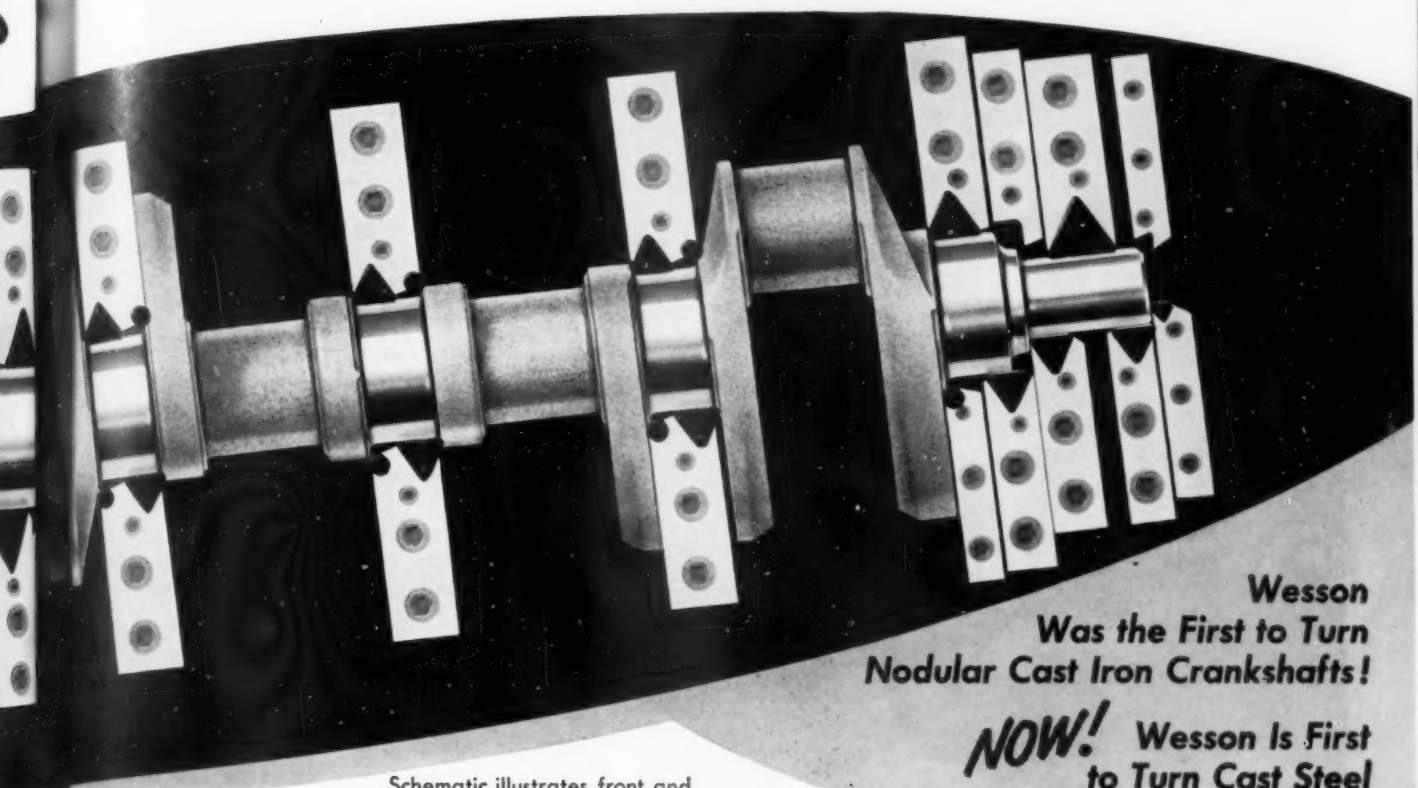


Wessonmetal uniformity of grade is the key to outstand performance in single and multiple insert set-ups on all t of material. Every Wessonmetal insert or batch of inser engineered to out produce on every type of operat Wessonmetal uniformity is the result of unique and exac quality control.

wmc

WESSON METAL CORPORATION
LEXINGTON, KENTUCKY

FIRST TO TURN CAST STEEL CRANKSHAFTS!

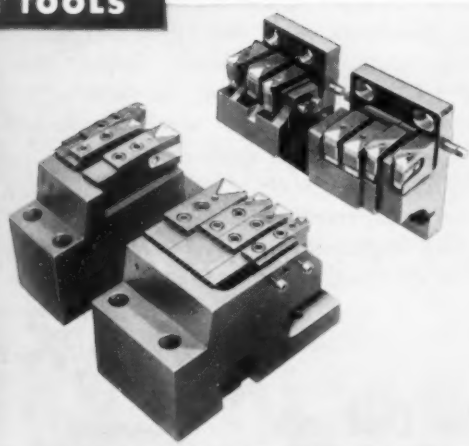


Wesson Was the First to Turn Nodular Cast Iron Crankshafts!

NOW! Wesson Is First to Turn Cast Steel Crankshafts!

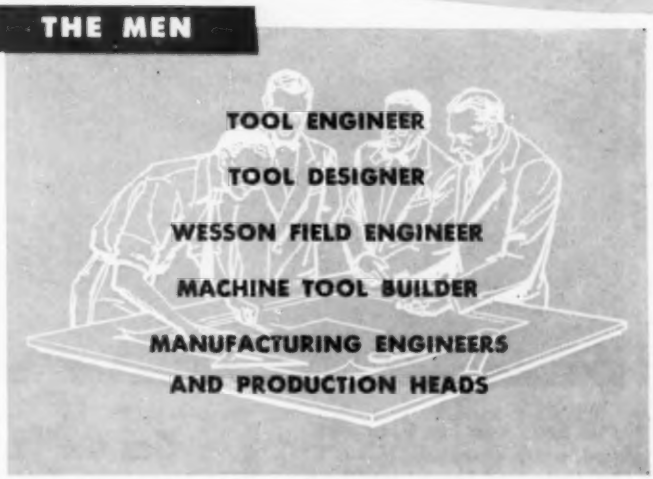
Schematic illustrates front and rear slides. Note special multiple tool adaptations possible *only* with Band-Type Multicuts!

THE TOOLS



esson Multicut Band-Type Tool Holders are tailor-made for le and multiple tool set-ups. Exclusive features include ilt-in flush gage" for quick, accurate insert set-up" in the chine; low cost steel band is replaceable, insert removal t permits fast and easy insert removal. The body is prac- lly indestructible! Available in over 100 standard sizes— styles!

THE MEN

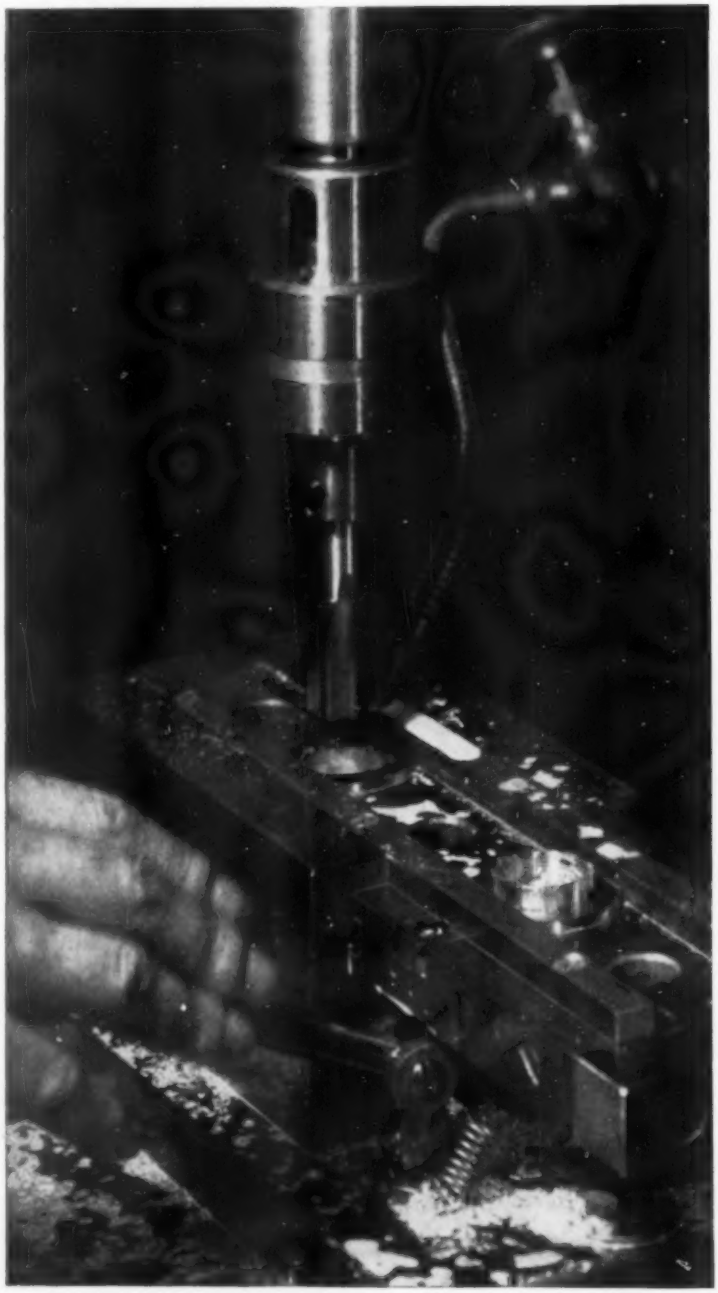


Credit lines above are typical of Wesson's thorough approach to "tough" tooling problems." Working together with the metallurgist, the Tool Engineer, Machine Tool Builder, and the customer, Wesson Field Engineers combine skill and experience in the solution of big jobs like the steel crank and single point tool applications in small production runs!

WESSON COMPANY

1220 WOODWARD HEIGHTS BLVD., FERNDALE 20, MICHIGAN

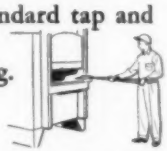
BESLY STANDARD TAPS Modified for Special Jobs



This Besly Tap has been modified to tap aluminum. It is a 1" by 12 Unified Thread model operating on a vertical tapper which produces aluminum coupling rings for electrical cable connectors.

...at no extra cost!
...with fast delivery!

You get fastest cutting and the most accurate threads when the taps you use are made for the material they cut. To better serve you, Besly modifies standard taps for your particular materials *at no extra cost.* The modification consists of altering the chamfer  and rake angle  of a standard tap and giving it special heat treating.



Since the modification is done on a tap "right off the shelf", we can make fast delivery. And, with the tap "tailored" to the material, it will out-perform standard taps.

This is one more special service available to Besly customers. Besly also specializes in giving you immediate delivery, through your nearby Besly distributor, of "standard" taps that will best handle most tapping jobs. And for those extra-tough applications, there's Besly's free field service with experienced tapping engineers on call at all times.

FREE TAP TIPS

The handy "Handbook for Tap Users" is full of information on tapping methods and tap selection. WRITE FOR YOUR FREE COPY.

You Get More When You Deal with

BESLY-WELLES
CORPORATION

118 Dearborn Avenue • Beloit, Wisconsin

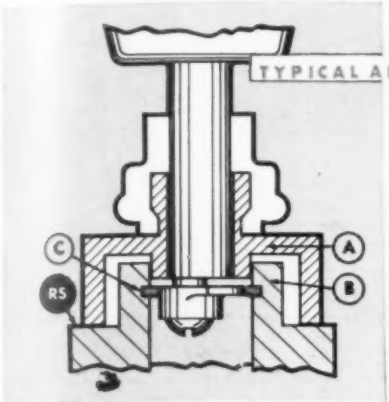
Established 1875 as Chas. H. Besly and Company

BRANCH OFFICES • Chicago • Detroit • Cleveland

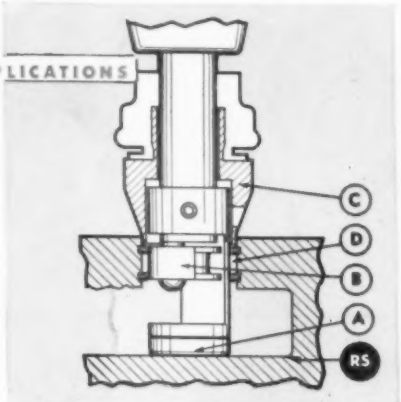
Waldes Truarc Grooving Tool Out-Performs Conventional Recessing Tools

SAVES TIME! CUTS COSTS! NEEDS NO SKILLED LABOR!

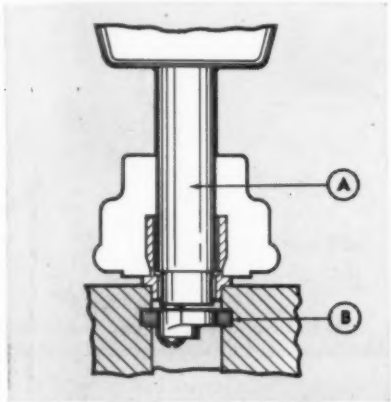
TYPICAL APPLICATIONS



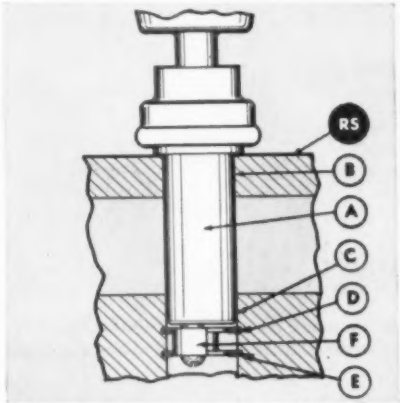
Clearing Obstructions or Protrusions — Waldes Truarc Grooving Tool with *special bushing* with high shoulder A in order to clear obstruction B on reference surface RS so groove can be properly located in bore.



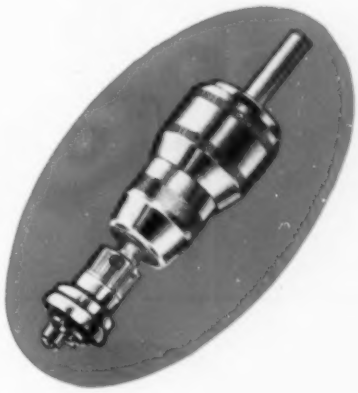
Locating Grooves from Bottom of Hole or Blind Hole—Use of *bottom adaptor* A and double cutter B. Bushing C pilots tool into bore D while bottom adaptor acts as stop to locate grooves from reference surfaces RS below bore.



Small Diameter Bore — Need for Wide Groove – Great versatility of tools allows A-2 Tool to accept *stepped down spindle* and *cutter-shaft* assembly A. Provides cutting capacity in a bore normally within the range of smaller A-1 Tool. Illustrated, larger tool capacity necessary to cut groove diameter B exceeding normal capacity of standard A-1 Tool.



Extending Reach of Tool – Waldes Truarc Grooving Tool assembled with *extended bushing* A increases normal range of tool in order to reach proper groove location in bore. Bushing also registers on reference surface RS of workpiece while piloting tool at two points B and C inside bore. Two grooves D and E are cut simultaneously with double cutter F.



AMAZINGLY VERSATILE! The Waldes Truarc Grooving Tool adapts quickly and simply to your toughest recessing requirements. With it, even *unskilled labor* can perform and maintain high precision, mass production operations.

WIDE CUTTING RANGE! The Waldes Truarc Grooving Tool comes in five models: A-1, A-2, A-3, B and C. This wide variety of models enables you to cut accurate grooves in housings with diameters from .250 to 5.000 inches. Special features, modifications and adaptations allow each model to operate efficiently under many varying conditions.

SEND YOUR PROBLEM TO WALDES! Whatever your internal grooving problem, send us your blueprints and let Waldes Truarc engineers give you a complete analysis, price quotation and delivery information on the most economical tool set-up for your particular job.

WRITE NOW FOR 20 PAGE TECHNICAL MANUAL CONTAINING FULL ENGINEERING DATA

WALDES

TRUARC

Reg. U. S. Pat. Off.

GROOVING TOOL

MADE BY THE MANUFACTURERS OF WALDES TRUARC RETAINING RINGS.

WALDES KOHINOOR, INC., 47-16 Austel Pl., L.I.C.1, N.Y. Waldes Truarc Grooving Tool mfd. under U.S. Pat. 2,411,426

TE096

Waldes Kohinoor, Inc., 47-16 Austel Place
Long Island City 1, New York

Please send me your new 20-page technical manual on the Waldes Truarc Grooving Tool.

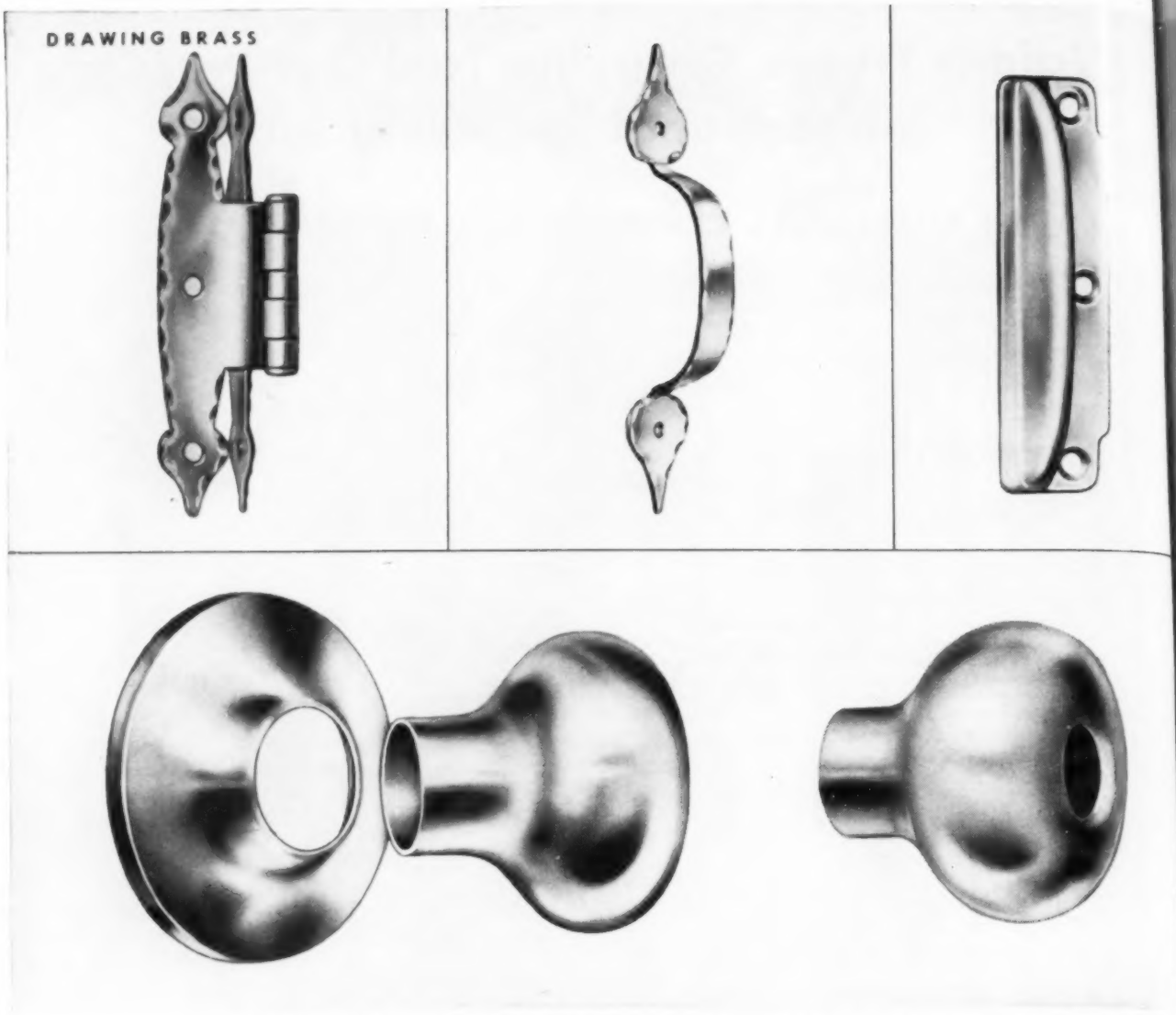
Name_____

Title_____

Company_____

Business Address_____

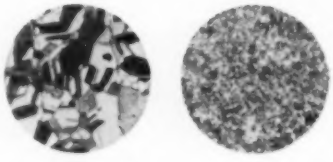
City_____ Zone____ State_____



THESE HARDWARE ITEMS are made by Adams Rite Mfg. Co., Glendale, Cal., and National Lock Co. and American Cabinet Hardware Co., both of Rockford, Ill. They are typical of the stamped, drawn and pressed products

Formbrite—Anaconda's new drawing brass—polishes up to

Superfine grain makes Formbrite harder, stronger, springier and more scratch-resistant



75X magnification of ordinary drawing brass. 75X magnification of superfine-grain Formbrite.

Here is what enthusiastic manufacturers of stamped and drawn brass products say about *Formbrite:*

". . . cuts our polishing costs up to 50% . . . eliminates some finishing operations entirely . . . gives amazingly sharp die impressions...resists scratching in handling . . . plates beautifully . . . gives a more lustrous finish . . ."

Yet *Formbrite** costs no more than the ordinary drawing brasses these manufacturers had been using. In fact, Formbrite very often saves more than the metal itself costs.

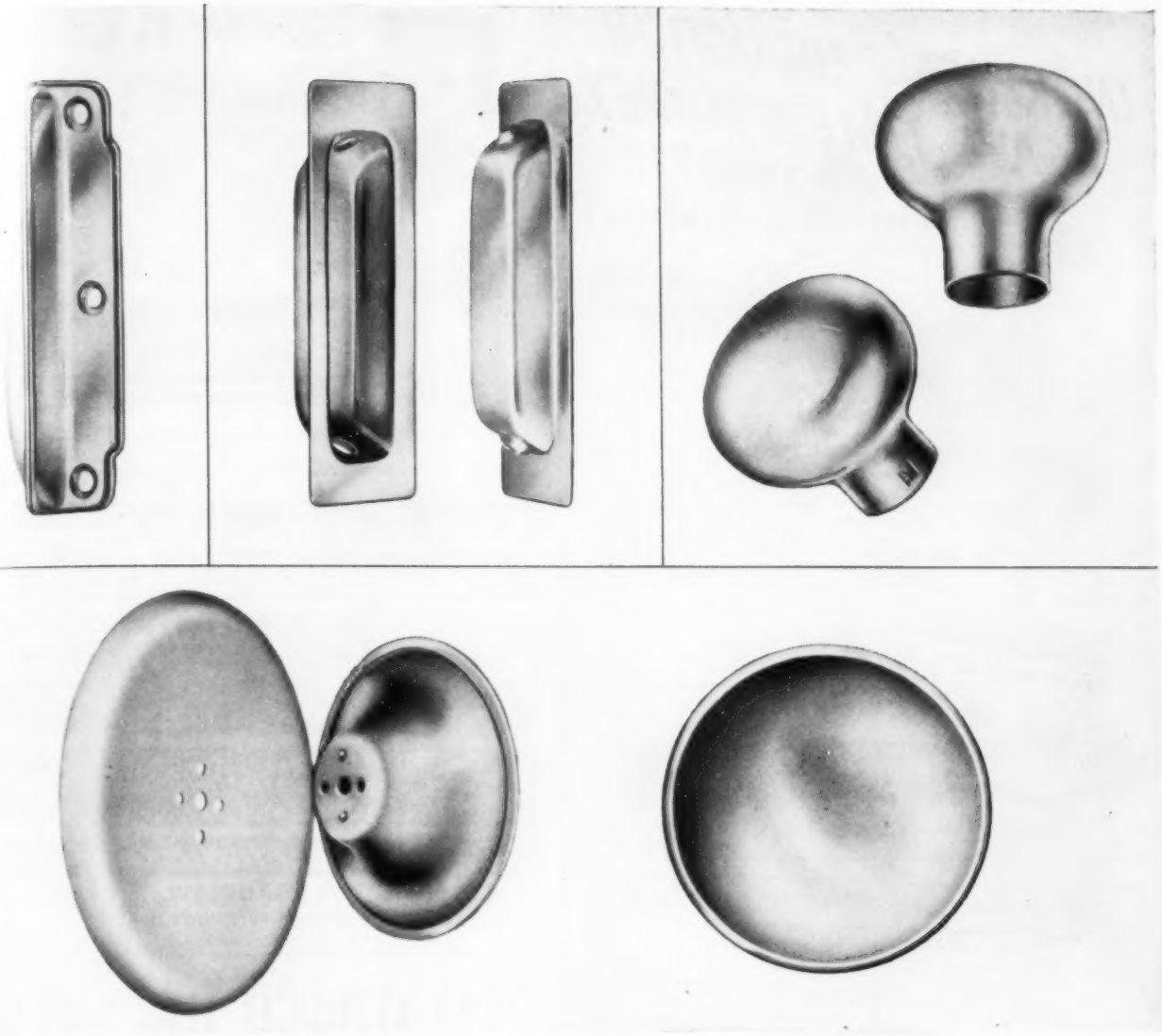
Why Formbrite is easier to use

Note Formbrite's superfine grain structure. Compare it with that of ordinary drawing brass. Special methods of rolling and annealing produce a grain structure so fine that often a simple color buff will bring it to a bright, lustrous finish.

Formbrite is also harder, stiffer, springier and more scratch-resistant . . . yet it is surprisingly ductile, readily stamped, formed, drawn and embossed.

Typical case

The Adams Rite Mfg. Co. makes the flush pull shown in the upper right



successfully made of Formbrite. Others include: lipstick holders, fishing lures, automobile hubcaps, gage cases, trophy nameplates, pen caps, etc. (Doorknob parts in lower left illustration have been chromium plated.)

50% faster... costs no more than ordinary drawing brass

illustration above. For this and many other building hardware items, they use Formbrite. They report:

"Formbrite increases surface hardness and rigidity of the part . . .eliminates several polishing operations and reduces over-all costs. Our flush pull definitely has been improved in quality."

Free sample

Formbrite is available in sheet, strip and coils—in all commercial widths and gages. Millions of pounds of this superior drawing brass have been made, sold and satisfactorily fabricated.

Want more proof? Mail the coupon and we'll send you a sample of Formbrite. Try it in your polishing room. See for yourself how quickly and easily Formbrite polishes. 5488

*Reg. U. S. Pat. Off.

Formbrite

FINE-GRAIN DRAWING BRASS

AN ANACONDA® PRODUCT

MADE BY THE AMERICAN BRASS COMPANY

FREE SAMPLE—Test Formbrite Yourself

The American Brass Company, Waterbury 20, Connecticut

(In Canada: Anaconda American Brass Ltd., New Toronto, Ont.)

☐ Send me a free sample of Formbrite to try in my polishing room.

☐ Send me Publication B-39, giving forming and finishing suggestions.

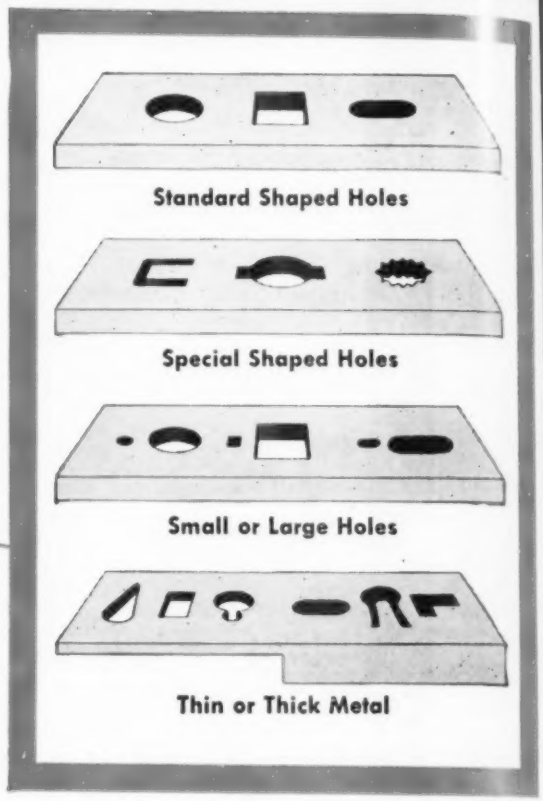
NAME .....

COMPANY .....

STREET .....

CITY ..... ZONE ..... STATE .....

WHEN R-B Punches Are Used



What are your piercing or forming requirements —standard or unusual shapes—small or large holes—steel or special alloys—thin or thick metals? There is either an R-B punch in standard shapes and sizes or R-B will manufacture special punches, die buttons and retainers to your specifications that will provide more efficient piercing operations.

Many hole-making applications, formerly requiring drilling or some other costly means, can now be done with R-B interchangeable punches. If you have thought your piercing jobs too tough for interchangeable punches, it will pay you to investigate the wide application potential of R-B standardized equipment.

R-B Engineering Service Is Available for Your Tough Piercing Problems.

RICHARD BROTHERS PUNCH DIVISION
ALLIED PRODUCTS CORPORATION
DEPT. 73 • 12667 BURT RD., DETROIT 23, MICH.

Please send me additional information.

NAME_____ TITLE_____

COMPANY_____

ADDRESS_____

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Also Produced in
OTHER ALLIED PLANTS
SPECIAL COLD FORGED PARTS
STANDARD CAP SCREWS
PRECISION GROUND PARTS
SHEET METAL DIES MADE OF FERROUS ALLOYS, ZINC ALLOYS OR PLASTICS

save
80% of
boring time
with

- Two Independent Means of Adjustment:
  1—Conventional Micrometer Screw Adjustment for increments of .001.
  2—Direct reading, **with naked eye, dial adjustment for increments of .0001 on diameter .00005 on radii.**
- Absolutely guaranteed to calibrate accurately and consistently. No backlash.
- Can be used in fixed or rotating applications, adaptable to any type of production or Tool Room equipment.
- All parts heat treated and ground. Hi-Alloy steels assure years of trouble-free service.

DEKA BORE

The only boring head with direct reading dial adjustment for increments of .0001 on diameter and .00005 on radii!

DEKA BORE is a cost saver on both long production runs and single piece work in jig boring. Its extreme close tolerance adjustment is perfect for the precision demands of automation and any type of precision boring. Most important of all, DEKA BORE **assures the quality of your finished products.**
You can make adjustments in fractions of 1/10,000 of an inch, on the full diameter, as easily as reading 1/16 of an inch on a steel rule. This is **not** a vernier or scroll adjustment. You can calibrate the DEKA BORE in increments of .00005 on radii or .0001 on diameter as easily as picking up .002 on a conventional micrometer dial. DEKA BORE IS 100% GUARANTEED TO GIVE YOU YEARS OF TROUBLE FREE USE. It has no parts to wear out, or go out of adjustment. DEKA BORE can be equipped with your choice of shanks at extra cost.

SPECIFICATIONS MODEL A-2

Body diameter	2¼"
Body length	3⅝"
Bar or tool capacity	½"
Tool Block slide	1⅛"W x 2⅝"L
Maximum Offset	½"
Bar or tool grip	1⅛"
Back threaded	⅝"–14
Weight	4¼ lbs.

▲ On this operation DEKA BORE saved 80% of the time previously spent on the same job. DEKA BORE is shown being used here on a vertical milling machine.

PRECISION TOOL & MFG. COMPANY OF ILL.
1305 SOUTH LARAMIE, CICERO 50. ILLINOIS

LET US DEMONSTRATE DEKA BORE IN YOUR PLANT, AT NO OBLIGATION TO YOU. WRITE NOW FOR THE NAME OF YOUR NEAREST DISTRIBUTOR OR FOR FREE LITERATURE.

Gentlemen: Please send me:
☐ the name of my nearest DEKA BORE distributor.
☐ more free literature and prices.
TR-9

NAME _____ TITLE _____
FIRM _____
ADDRESS _____
CITY _____ ZONE _____ STATE _____

Only SUPERIOR

PRECISION—ALL STEEL

DIE SETS

Give You These

3 Features

For Safer Faster Handling

1 SAFETY FLANGE

protects fingers by providing roomy gripping space on either side of the die shoe. This flange may be mounted flush or on the edge of the die set and is welded in place. *There is no extra charge for this valuable safety feature.*

2 LOCK JAW LIFTING DEVICE

removes the danger of handling large die sets. Heavy steel components of this device are welded in place forming an integral part of the die set. They are positioned to insure proper balance when the set is lifted by either chain fall or crane.

3 E-Z LIFT SLING CHAIN

is especially designed to fit the safety flanges of the die sets. Male jaws attached to the sling fit quickly into place for immediate lifting. There is no need for screw clamps, eye bolts, or lifting lugs. Nor is there danger of distorting stresses being set up in the die or set because of improper lifting.

It's no longer necessary to take needless risks in handling die sets. Risks that might easily injure the hands of skilled die makers, ruin costly dies in process or completed, or even damage press equipment. Safety features of Superior die sets have eliminated all of these dangers and have speeded up the overall handling of sets from the bench to the press. Prove to yourself the merits of these safety features in both small and large die sets.

FREE CATALOG—*Write today for this helpful data on Superior die sets and die makers' supplies.*

SUPERIOR STEEL PRODUCTS CORP.
2754 S. 19th ST., MILWAUKEE, WIS.

For Fast Local Service Call these Expert Superior Representatives

- Kalamazoo, Mich.—Phone 7988
- Indianapolis, Ind.—BRoadway 5668
- Chicago, Ill.—RAndolph 6-8871
- Dallas, Tex.—Riverside 5138
- Rockford, Ill.—Phone 3-3932
- St. Louis, Mo.—JEfferson 5-1223
- Milwaukee—MItchell 5-6027
- Dayton, Ohio—Hemlock 6209
- Atlanta, Ga.—ATwood 7771
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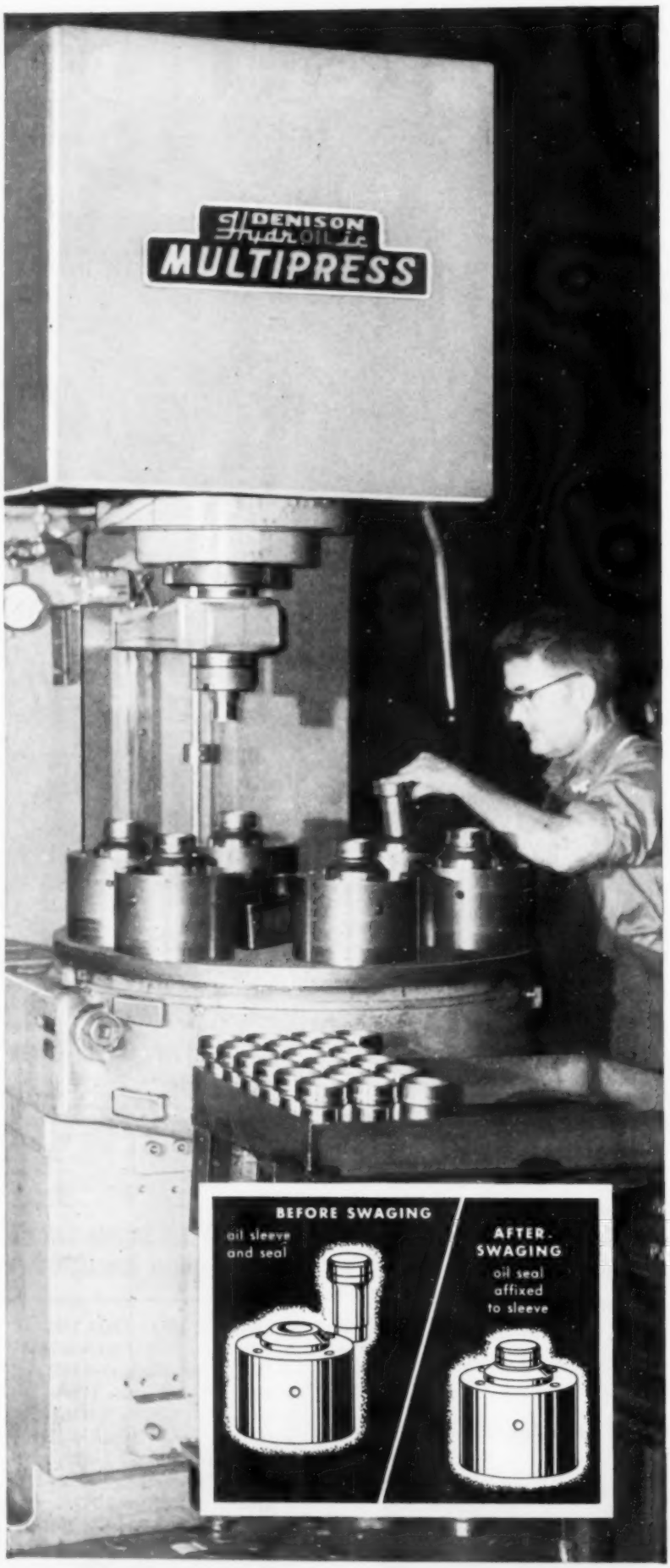
- Eau Claire, Wis.—2-3453
- St. Paul, Minn.—PRior 6485
- Detroit, Mich.—FOrest 6-4893



Hired for one job— this DENISON MULTIPRESS® does 21 more

INTERCHANGEABLE tooling and an accurate, fast-acting Denison Index Table make it possible.

This 75-ton Denison hydraulic Multipress with six-station Index Table handles 22 swaging jobs for Mechanics Universal Joint Division, Borg-Warner Corporation.

For setup, the operator simply changes punches. The Denison Index Table, hydraulically interlocked with the Multipress ram, indexes from 10 to 70 times a minute . . . maintains limits of plus-or-minus two-thousandths.

This application—ring-swaging oil seals for universal-joint assemblies—shows what Multipress can do. Replacing a punch press, Multipress raised production 36 per cent . . . lowered labor costs 30 per cent.

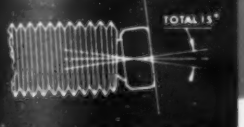
Denison Multipress combines speed, accuracy and safety for swaging, testing, assembling and many more applications in the 1-to-75-ton pressure range. For bulletins, write to:

THE DENISON ENGINEERING COMPANY
1182 Dublin Road • Columbus 16, Ohio

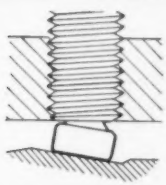
DENISON Hydr OIL ics

Here's the secret to positive clamping... freedom from marring!

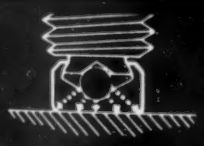
the New Vlier SCREW-BALL CLAMPS!



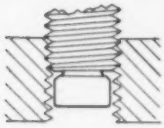
Ball-bearing construction insures frictionless, *automatic* angle adjustment and rotation; pad swivels freely in *all* directions up to 7½° from the centerline!



Pad seats firmly on work surface within angular range!



Force distributed equally to pad face. Conical seat distributes force equally in all directions; insures easy alignment in angular applications; greater freedom of motion.



Pad inserts from top of threaded hole or from bottom for easy installation!

Large pad area. Pad is machined from the solid, not counterbored or relieved; has greater strength plus freedom from distortion!

NO MORE EXPENSIVE, CUSTOM-MADE SWIVEL PADS . . . 17 size variations; ¼" O.D. up. N.C. threads; class 2 fit.

LOW COST... Saves hundreds of dollars annually in toolmaker's time!

NO MARRING... Rotation of pad ceases at first touch against the work! Soft seat saves surfaces!

HEX SOCKET HEAD... for easy hex key adjustments!

BLACK AS THE ACE OF SPADES! Completely rust proofed end to end!

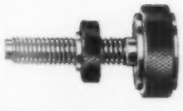
KEEP VLIER SCREW-BALLS IN STOCK FOR INSTANT USE — SAVE YOUR TOOLMAKER'S TIME!

Ask your Vlier Distributor for an assortment of sizes today!

VLIER ENGINEERING INCORPORATED

4825 RADFORD AVENUE · LOS ANGELES 4, CALIFORNIA

MONEY-SAVING TOOLING SPECIALTIES FOR EVERY REQUIREMENT!

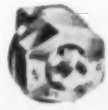


TORQUE THUMB SCREWS — Apply accurate, controlled end pressures; eliminate distortion to the workpiece. 4 models; 19 sizes!

VLIER SPRING PLUNGERS — For use wherever accurate, positive spring loads are needed! 4 models; 40 sizes!

VLIER SPRING STOPS — Provide end pressures in fixtures when wall sections are not available. Two models: 14 and 32 lbs. end pressure.

VLIER TOGGLE PADS — Assure solid clamping of parts with uneven or off-angle surfaces. 5 sizes; fit almost any clamp.



VLIER FIXTURE KEYS — New 5-Way Key fits every standard mill table slot. 3-Way model also available.

Write for your complete catalog of Vlier products today! It's free!

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REAMERS

is service and control

accurate size, selective finish, maintenence, sharpening

. . . all are important to the number and quality of holes you ream. Singly or together, these factors control the cost and cutting life of your reamers.

Barber-Colman Reamers are designed and built to furnish you with control over all factors at all times. A highly trained reamer service organization responds promptly to your requests for assistance on special reaming problems.

Barber-Colman Reamers give you both . . . service and reamer control. Send prints for recommendation and specifications.

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Barber-Colman Company

GENERAL OFFICES AND PLANT, 999 ROCK STREET, ROCKFORD, ILLINOIS

pioneers in

reamer design
reamer finishes
reamer sharpening

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-9-262

CKES Smalley General Thread Millers

FORD MOTOR COMPANY

WICKES Smalley General Thread Millers have long been known for their efficient operation. Finish and accuracy obtained eliminate grinding. Efficient on internal or external threads. Note this typical case —

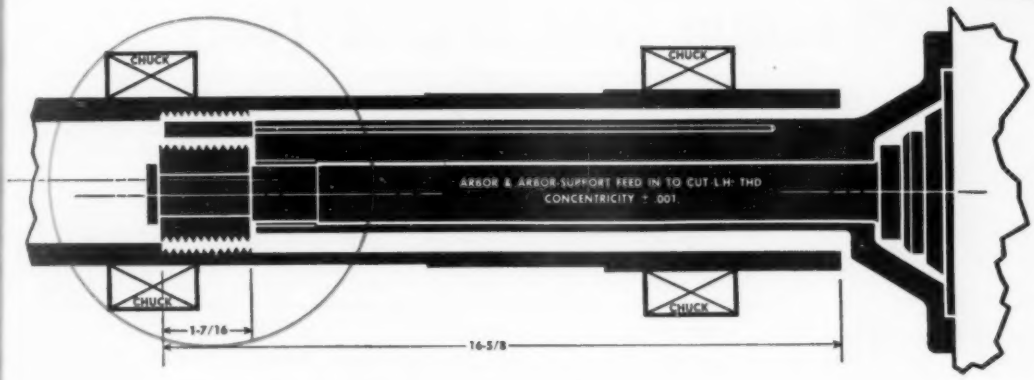
Part: Jet Engine Turbine Shaft
Metal: AMS 6415 Steel heat treated to Rockwell C-35-40

Milling internal thread:
Size 5.3125 — 16 NLH —
P. D. 5.2719 — 5.2785

Thread milling cutter speed:
70 F.P.M.

Work feed: 5 inches per minute

Milling cycle: 5.9 minutes @ 100%



Available WICKES Smalley General Machines:

Size:	#18	#30	#44
Weight:	14,000 lbs.	23,000 lbs.	29,000 lbs.
Capacity:	8¼" hole thru spindle	17" hole thru spindle	18½" hole thru spindle

Send for latest bulletin on any of these machines.

100 YEARS' EXPERIENCE IN SOLVING PRODUCTION PROBLEMS

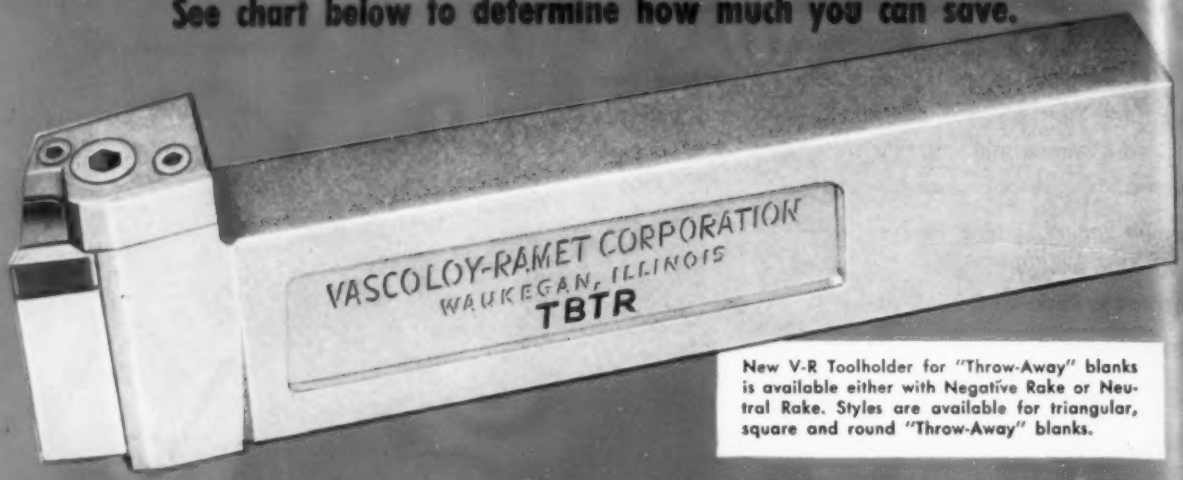
WICKES BROTHERS · SAGINAW, MICHIGAN

DIVISION OF THE WICKES CORPORATION

83

NOW Cut Your Carbide Tooling Costs in Half!

See chart below to determine how much you can save.



New V-R Toolholder for "Throw-Away" blanks is available either with Negative Rake or Neutral Rake. Styles are available for triangular, square and round "Throw-Away" blanks.

with V-R Toolholders* and "Throw-Away" Blanks!

- No Chipbreaker Grinding
- Lower Tool Inventory
- Available with Negative or Neutral Rake
- No Carbide Grinding
- Cutting Edge Automatically Positioned
- Another Cutting Edge Quickly Available

More Economical Than Brazed Tools

Compare The Cost Per Cutting Edge...

The costs on a brazed tool's useable cutting edges are:

1. Original cost of the tool
2. Cost of each regrind
3. Number of regrinds obtainable

Formula for computing cost per cutting edge

V-R "Throw-Away" Blank Cost Per Cutting Edge								
"Throw-Away" Blank Style and Size	Triangular				Square		Round	
	1/4"IC	3/8"IC	1/2"IC	5/8"IC	3/8"sq	1/2"sq	3/8"	1/2"
Utility Class for NEGATIVE RAKE Type	.06	.10	.20	.33	.07	.15	..	..
UTILITY Class for NEUTRAL RAKE Type	.12	.20	.40	.66	.15	.30	..	..
PRECISION Class for NEGATIVE RAKE Type	.10	.17	.27	.42	.13	.23	.06	.11
PRECISION Class for NEUTRAL RAKE Type	.20	.34	.54	.84	.27	.47	.16	.26

$$\frac{\text{(Cost of Tool)} + \text{(No. of regrinds} \times \text{cost per grind)}}{\text{Number of regrinds} + 1 \text{ (for original tool)}} = \text{Cost per cutting edge}$$

Compute the cost per cutting edge for a typical brazed tool you use and compare it with cost per cutting edge of a "Throw-Away" blank!

Write Today for New Toolholder Catalog and Price List VR-436

V-R Toolholders are also available for holding triangular, square and round inserts up to 1½" long. See Toolholder Catalog VR-435.

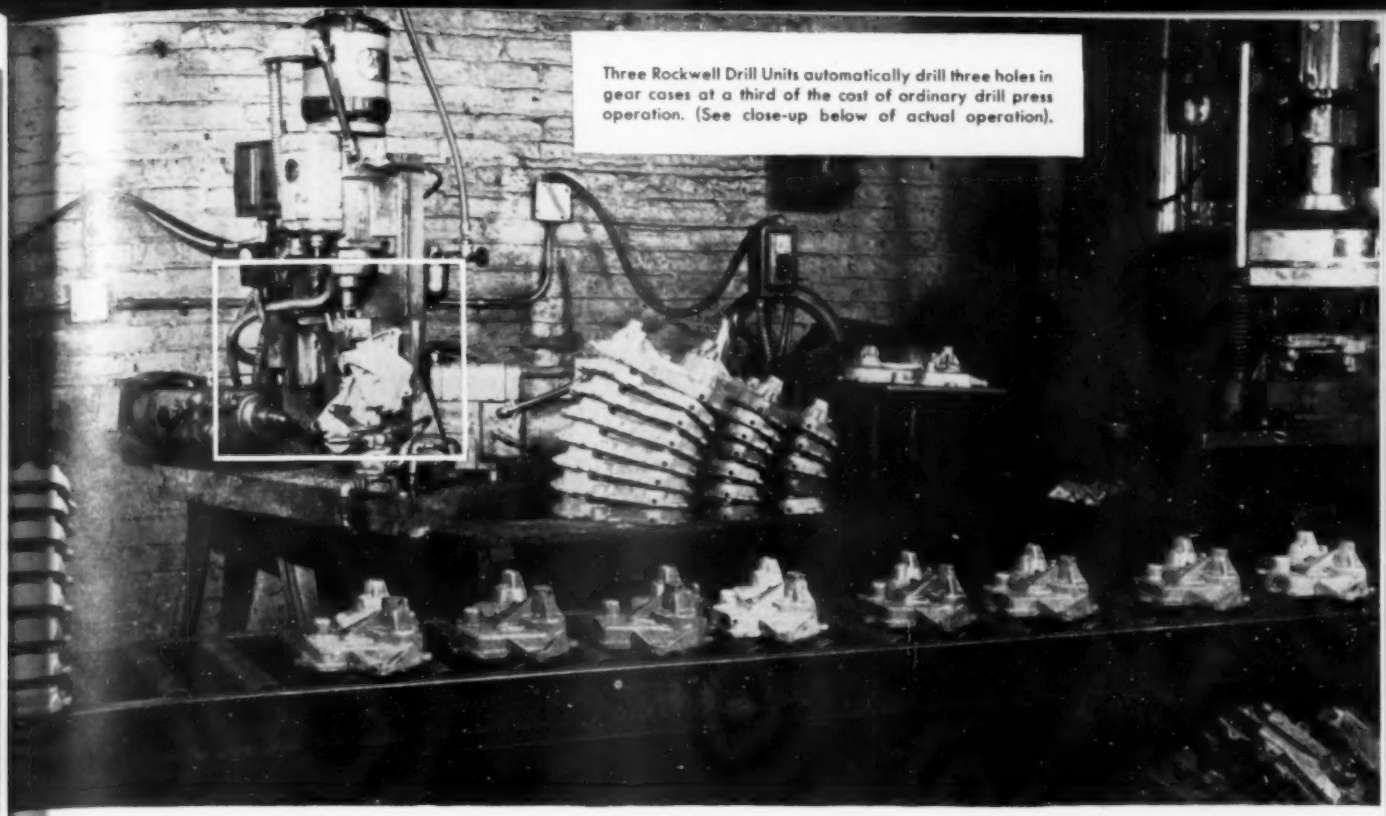
Vascoloy-Ramet CORPORATION

Since 1933—Makers of

THE WORLD'S FINEST CARBIDE

852 MARKET STREET, WAUKEGAN, ILLINOIS

*Patent Pending



Three Rockwell Drill Units automatically drill three holes in gear cases at a third of the cost of ordinary drill press operation. (See close-up below of actual operation).

How Woodruff and Edwards Cut Cost 61.77% On Gear Case Machining Operation With Rockwell* Drill Units

Before tooling up to machine gear cases that were to be produced under contract *for the Whirlpool Corporation, Woodruff and Edwards, Inc.* (Elgin, Illinois, foundry and production jobbing firm) conducted comparative cost studies of conventional drill presses versus Rockwell Air-Hydraulic Drill Units. The operation involved drilling three holes at various angles into the gear case. It was determined that these operations performed on drill presses would require 1.04 minutes, at a cost of $.0936 per part.

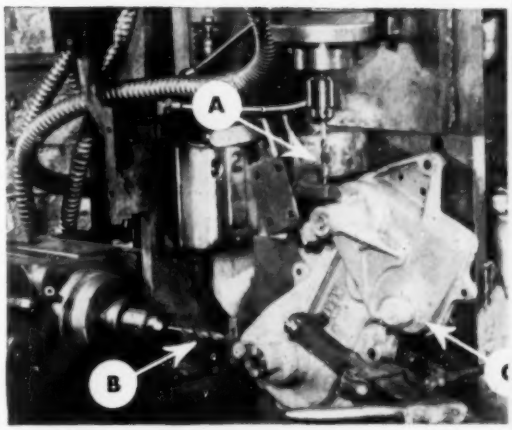
On the basis of this cost study, Woodruff and Edwards installed three Rockwell Drill Units on a simple weldment, around an inexpensive holding fixture. With this shop built machine, they do the job in 0.4 minutes floor to floor time, at a cost of $.036 per part—a saving of 61.77%.

Richard W. Hampel, Superintendent of Woodruff and Edwards' Manufacturing Division, points out: "They could do even better if we'd let them. Our Rockwell Drill Units operate at the station following the automatic boring machine, and output is limited by the boring machine's cycle time.

"Our Drill Unit machine is operated by the boring machine operator on idle time, giving us practically a free operation." This is one of the advantages of remote-automatic operation.

Rockwell Drill Units are available for plant demonstration through Rockwell Sales Engineers, who are also equipped to offer engineering aid in conducting cost studies on operations involving production drilling, tapping, counter-boring and similar operations.

Full information is available by writing to: Drill Unit Division, Rockwell Manufacturing Company, 306J North Lexington Avenue, Pittsburgh 8, Pa.



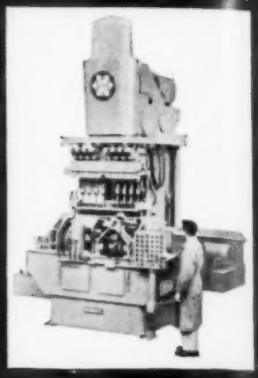
Triggered by the air clamp that secures the gear boxes, the Rockwell Drill Unit machine: (a) drills a 5/32" hole at a 45° angle through the underside of the casting; (b) drills a 7/32" hole vertically through a 1½" boss; and (c) with a Letter "R" drill, drills an oil plughole. All three units retract independently.

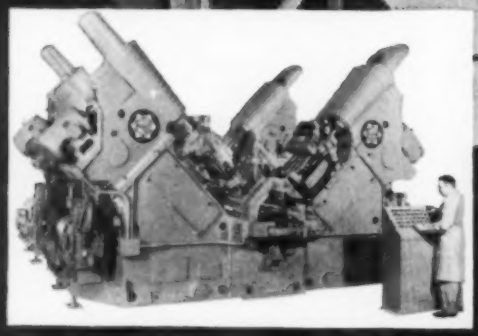
FOR

Production • Accuracy • Economy

V-8 Cylinder Blocks are MICROHONED Automatically on NEW Model 420 Hydrohoners ☆

Specifications of this model are included in our general catalog—obtainable at the offices listed below.





This multiple-spindle, heavy-duty model is designed to fit any type of production line. Examples of its adaptability: above, two four-spindle machines with tip-up fixtures; left, V-type; upper right, eight spindle vertical.

1929 • 1954 — 25TH YEAR OF DEVELOPMENT — PRECISION PRODUCTION THROUGH MICROHONING — MICRO MATIC

MICROMATIC HONE CORPORATION

8100 SCHOOLCRAFT AVE., DETROIT 38, MICHIGAN

MICROMATIC HONE CORP.
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REPRESENTATIVES: Allied Northwest Machine Tool Corp., 103 S.W. Front Ave., Portland 4, Oregon • Mason Machine Tool Company, 415 So. Second East, Salt Lake City, Utah • Tidewater Supply Co., Charlotte 4, North Carolina

REPRESENTATIVES IN ALL PRINCIPAL COUNTRIES

SUBSIDIARY:

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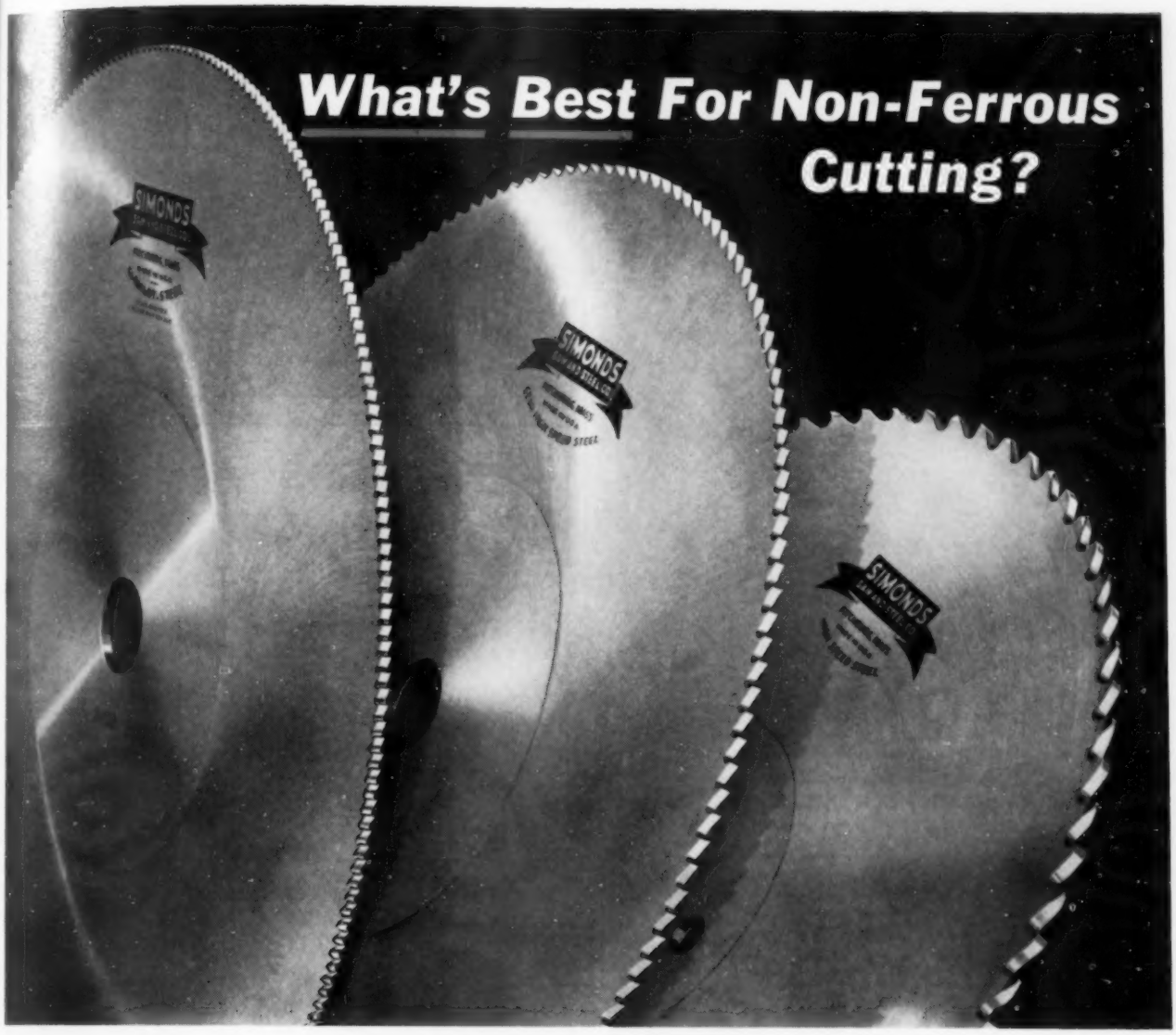
Hydraulic Controls • Diesel fuel injection equipment



SIMONDS Circular Metal Saws

SI-MALOY* STEEL SAWS, made of Simonds patented steel especially developed for sawing non-ferrous metals, provide longer cutting life, greater economy in all but the most abrasive non-ferrous alloys. Costing more than Semi-High Speed Steel Saws, they give more service between sharpenings. Costing the same as High Speed Steel Saws, they're tougher, more break-resistant and hold a cutting edge equally well. Si-Maloy Saws are clearance ground and available in a wide range of stock sizes.

SEMI-HIGH SPEED STEEL SAWS are normally applied where production requirements are limited. Tougher, more resistant to cracking, they're more economical to use on jobs where saws are subject to abuse. Furnished clearance ground or with teeth set for clearance, Semi-High Speed Saws are available in a wide range of stock sizes.

HIGH SPEED STEEL SAWS provide the ultimate in cutting life on all types of non-ferrous alloys, but won't take as much abuse as Si-Maloy Saws. Furnished clearance ground in a wide range of stock sizes. Simonds Steel, modern heat-treating, grinding and production methods insure longer, trouble-free service from every saw with the familiar Simonds ribbon trade mark. Write for Bulletin M-80 for further information.

For quick deliveries large or small
Give your Simonds Distributor a call

SIMONDS SAW AND STEEL CO.
FITCHBURG, MASS.

*Steel Analysis Patented No. 2,204,283

Factory Branches in Boston, Chicago, San Francisco and Portland, Oregon, Canadian Factory in Montreal, Que., Simonds Division: Simonds Steel Mill, Lockport, N. Y. Simonds Abrasive Co., Phila., Pa., and Arvida, Que., Canada

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TO OBTAIN FURTHER INFORMATION ABOUT ADVERTISERS, TRADE LITERATURE OR TOOLS OF TODAY APPEARING IN THIS ISSUE OF THE TOOL ENGINEER, USE THE HANDY READERS SERVICE CARD ON PAGE 137.

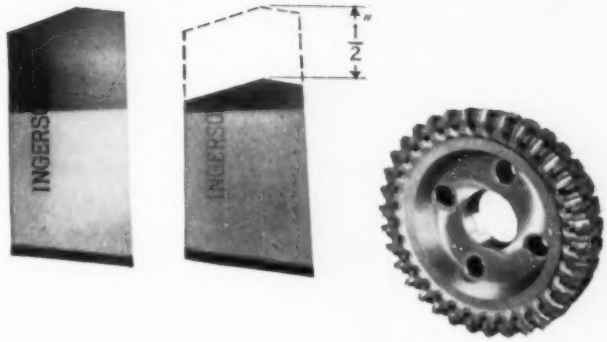
INGERSOLL REPLACEMENT BLADES

The *longer cutting life* of Ingersoll replacement blades should be a primary consideration in the purchase of cutting tools. High quality Ingersoll precision blades designed for Ingersoll milling cutters give better performance at low cost for these reasons . . .

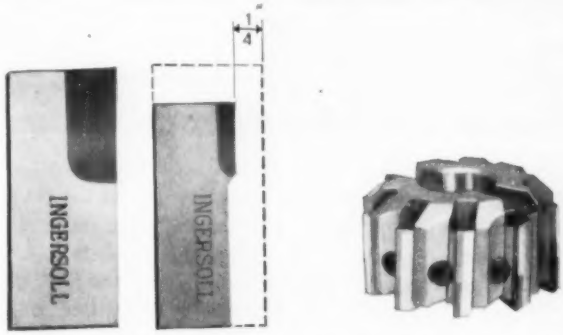
- √ **Use of efficient, up-to-date production equipment** in the manufacture of blades and cutters.
- √ **Integrated design of blades and cutter** for most effective cutting action.
- √ **Specific grades and correct arrangement of carbide** in blades for your particular work.
- √ **Value of knowledge and experience** gained during 65 years of building special machines and cutters to meet varying customer needs.

Most standard Ingersoll blades are available from stock . . . carbide-tipped, cast alloy, high speed steel . . . plain, serrated, helical.

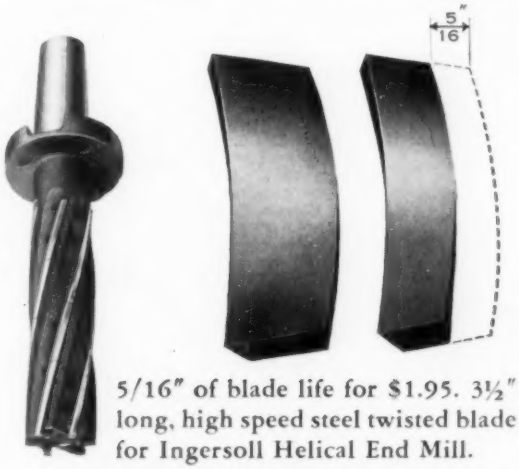
1/2" OF CUTTING LIFE FOR $1.40



Costing only $1.40, this carbide-tipped blade for an Ingersoll Shear Clear Face Mill gives as much as ½" of wear while rough milling cast iron at high feed rates.



¼" of blade life for $1.00. Carbide-tipped blade for Ingersoll 4" dia. Type NX Face Mill.

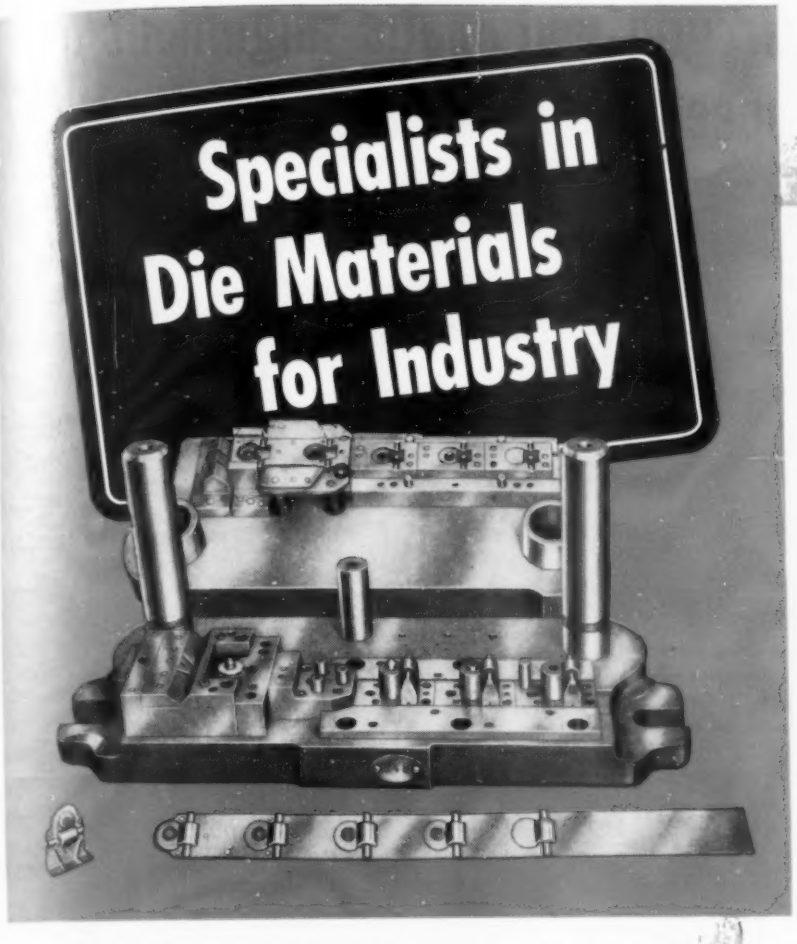


5/16" of blade life for $1.95. 3½" long, high speed steel twisted blade for Ingersoll Helical End Mill.

Write for Catalog 60F, describing Ingersoll inserted blade face mills, end mills, helical slab mills, side mills, arbor cutters, angular cutters and boring heads.

THE INGERSOLL MILLING MACHINE COMPANY
ROCKFORD, ILLINOIS, U.S.A.

BUILDERS OF SPECIAL DESIGN MILLING & BORING MACHINES
ORIGINATORS OF SHEAR CLEAR CUTTERS



A COMPLETE LINE...CARBIDE AND STEEL

Firth Sterling offers manufacturers and fabricators the advantages of a *single* source of supply of materials for both tungsten carbide and steel shaping, forming, piercing, heading and other dies. This *complete* line, from famous Firthaloy, for maximum performance where carbide is a requirement, through almost one hundred grades of high speed and tool steels for cut-off knives, roll guides, die casings, forming rolls and similar applications, provides the exactly right material for each application. Maximum production at lowest cost is thus assured.

Standard items are available from warehouse stocks; others may be obtained from your local tool and diemaker.

Firth Sterling representatives are skilled in interpreting the needs of industry and in suggesting the exactly right steel or carbide for specific applications. Because they know and sell both, you can depend on their unbiased recommendations to result in better, more economical tooling.

Attention: Fastener Industry! C.H.Q. Die Steel makes cold heading records

C.H.Q. solid die after 192,000 run.

A nationally known fastener manufacturer* recently made comparative tests of solid steel cold heading dies, under carefully controlled conditions, producing ⅝" square head machine bolts from 1020 steel on a Waterbury Farrel double stroke automatic.

Firth Sterling C.H.Q. came off with top honors and the highest production ever obtained by this manufacturer from any steel die . . . 192,045 both ends. (78,860 one end, 59 Rockwell C; 113,185 other end, 61 Rockwell C.) Standard competitive carbon steel dies produced only 50,000-60,000 both ends and ultimately failed by cracking axially. The C.H.Q. die wore oversize but longitudinally etched section revealed not even a hairline crack.

Ask for technical literature on C.H.Q.—or a Firth Sterling representative will discuss your die problems.

*(name on request)

R-299-A

Firth Sterling

—INC—

GENERAL OFFICES: 3113 FORBES ST., PITTSBURGH 30, PA.

OFFICES AND WAREHOUSES*: BIRMINGHAM CHICAGO* CLEVELAND DAYTON DETROIT* HARTFORD* HOUSTON LOS ANGELES* NEW YORK PHILADELPHIA PITTSBURGH WASHINGTON WESTFIELD, N.J.

PRODUCTS OF FIRTH STERLING METALLURGY

High Speed Steels
Tool & Die Steels
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Sintered Tungsten Carbides
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Chromium Carbides
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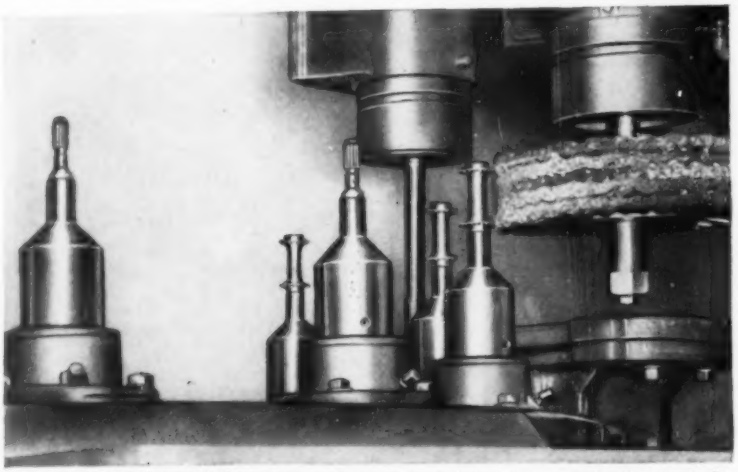
Zirconium

Self-release, greater grip, automatic alignment o
ERICKSON MANDRELS speed small to large part loadi g



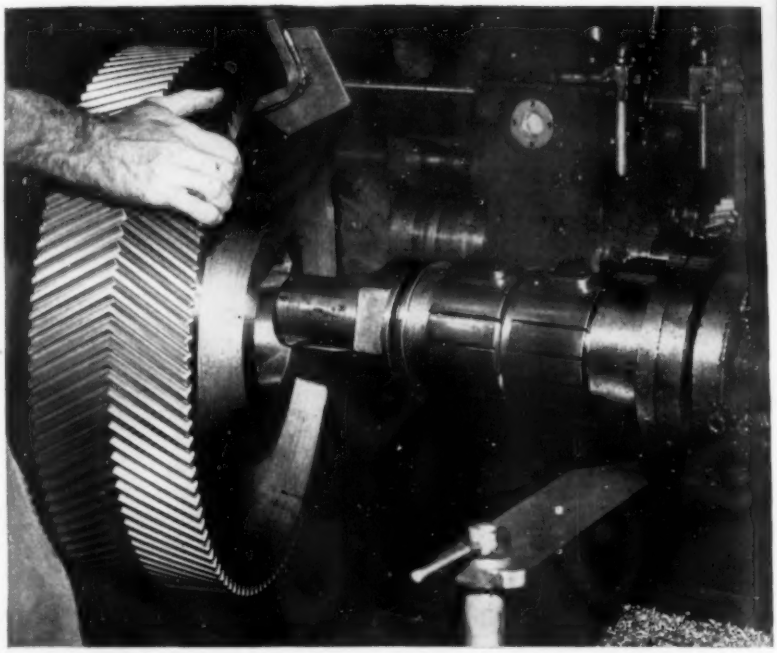
SMALL ERICKSON MANDRELS play a big part in holding down production costs for leading bicycle parts manufacturer. Here you can see how Erickson drawbar-operated, precision expanding mandrels speed wheel hub loading for buffing operation. Ease of operation and instantaneous release have greatly speeded this quantity production holding problem.

Regardless of size, Erickson precision expanding mandrels operate on Erickson's famous double-angle principle that not only assures guaranteed accuracy of .0005" T I R, but also makes mandrels self-releasing. They are available for air, hydraulic or manual operation. Special mandrel sleeves are designed to match various internal forms. AA-72

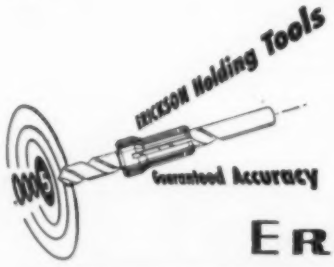
ERICKSON MANDREL ADVANTAGES

- Instantaneous self-release greatly speeds loading and unloading
- Greater holding power because grip extends over entire sleeve length . . . stops wobble and chatter
- Guaranteed accuracy of .0005" T I R
- Each sleeve covers a range of 1/32"
- Sleeves are interchangeable on mandrels of same series

Are you bothered by a tough internal holding problem? Then let us prove that Erickson mandrels speed production for lower unit costs. Give us a call today or write for catalog K.



ERICKSON MANDRELS speed large part handling, too. See how easily this heavy shovel gear, 24 inches in diameter, is being loaded for gear cutting at the Alten Foundry and Machine Works, Inc., Lancaster, Ohio. Larger shovel gears up to 61 inches in diameter are handled just as easily. At Alten Foundry, using an Erickson mandrel, loading and automatic alignment require only 10 percent of the time required by plants using solid arbors and arbor presses. Even this large mandrel is self-releasing. Operator fatigue is practically eliminated.



ERICKSON TOOL COMPANY

2303-S Hamilton Avenue • Cleveland 14, Ohio

COLLET CHUCKS • FLOATING HOLDERS • TAP CHUCKS • TAP HOLDERS • AIR-OPERATED CHUCKS
EXPANDING MANDRELS • SPECIAL HOLDING FIXTURES

Buhr SPECIAL...

Drills, spot-faces, chamfers and taps 670 differential-carrier bearing caps an hour!

Featuring *fully automatic clamping* and *a special combination drilling-and-tapping head* with an independent lead-nut plate —

This 5-station automatic-indexing dial-type Buhr Special, holding four parts per station, machines 670 pieces per hour at 100% efficiency.

Operations include drilling and spot-facing two bolt holes, and drilling, chamfering and tapping the center hole of each bearing cap.

Tapping spindles are of the individual lead-screw type with precision-ground and hard chrome-plated threads — a Standard Buhr Feature.

A phone call, telegram or letter will bring you our complete Buhr Specials Catalog or a consultation with one of our sales executives.

BUHR MACHINE TOOL COMPANY
252 GREEN STREET, ANN ARBOR, MICHIGAN

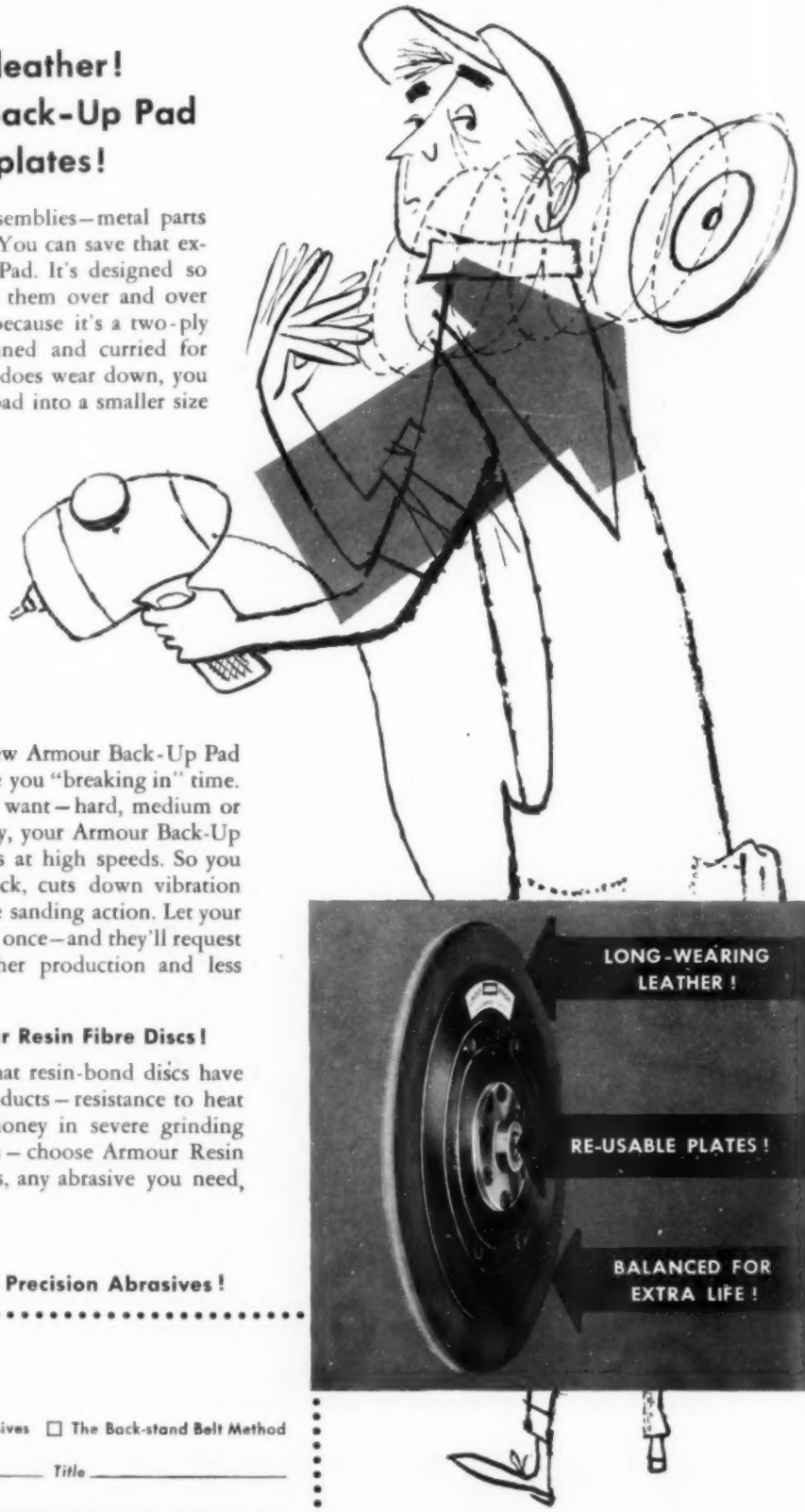
MULTIPLE-SPINDLE HIGH PRODUCTION MACHINERY

Solidly Engineered . . . Precision Built . . . for World's Leading Manufacturers

Don't throw away that back-up pad!

Just replace the leather! It's the new Armour Back-Up Pad with re-usable plates!

Are you throwing away your back-up assemblies—metal parts and all—when just the pad wears out? You can save that expense with the new Armour Back-Up Pad. It's designed so you can detach the steel plates and use them over and over again! The pad will last longer, too, because it's a two-ply construction of the finest leathers, tanned and curried for resistance. And when the leather finally does wear down, you can save money by cutting the Armour pad into a smaller size—it's as good as new!



Another money-saving feature of the new Armour Back-Up Pad is that it's tailored at the factory to save you "breaking in" time. You can even order the flexibility you want—hard, medium or soft! And to guarantee perfect flexibility, your Armour Back-Up Pad receives four precision-balance tests at high speeds. So you can be sure that your pad absorbs shock, cuts down vibration and provides the disc with smooth, safe sanding action. Let your workmen test this precision-balance pad once—and they'll request Armour Back-Up Pads always for higher production and less operating fatigue!

Use these new pads with Armour Resin Fibre Discs!

Actual production tests have proved that resin-bond discs have two big advantages over glue-bond products—resistance to heat and resistance to moisture. So save money in severe grinding operations and edge-wear grinding jobs—choose Armour Resin Fibre Discs! And for belts, rolls, sheets, any abrasive you need, call on Armour today!

Learn more about Armour's Precision Abrasives!

ARMOUR AND COMPANY,
North Benton Road, Alliance, Ohio

Please send me free booklets on:

☐ Armour Back-Up Pads ☐ Storing Abrasives ☐ The Back-stand Belt Method

Name _____ *Title* _____

Firm _____

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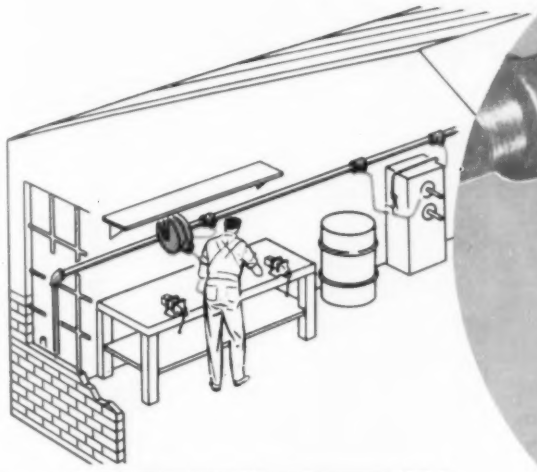
City _____ *Zone* _____ *State* _____

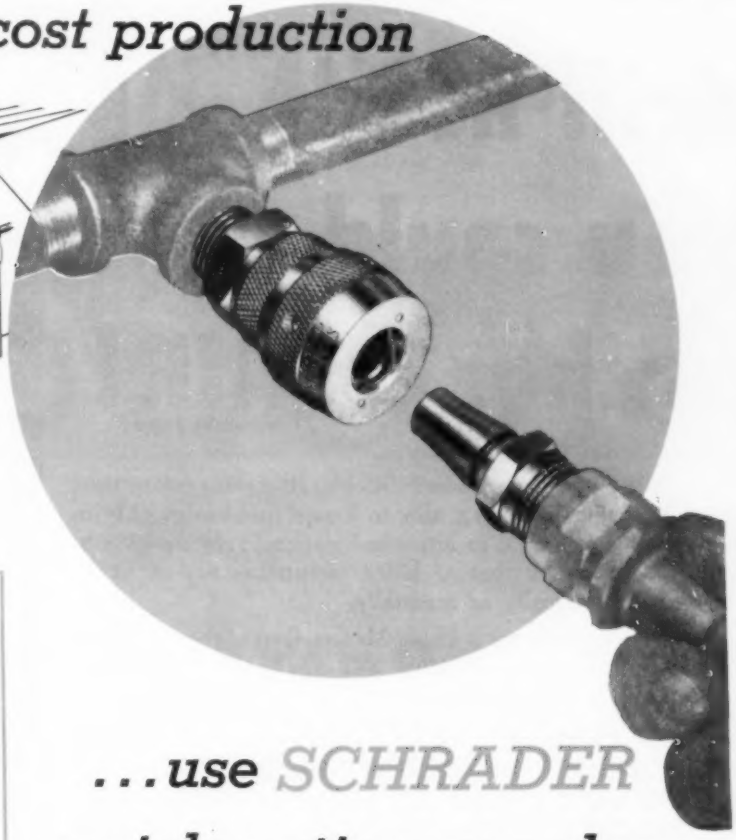
T-9

ARMOUR *Coated Abrasives*

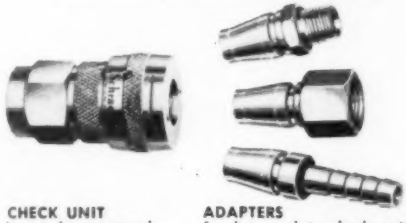
Armour and Company • Alliance, Ohio

Make your Air Lines Pipe Lines to low cost production





THE SCHRADER COUPLER



CHECK UNIT
heavy duty or standard type — with or without swivel — with male or female inlet threads

ADAPTERS
for heavy duty check units — or standard units — with male or female threads, or serrated shank — for many pipe and hose sizes

. . . use SCHRADER quick-acting couplers

Spot **Schrader Couplers** everywhere in your plant—along benches . . . on columns . . . *wherever an air outlet means convenience.* Schrader Quick-Acting Couplers make air as easy to "plug in" as electric current. Yes, bring air to the job, not the job to the air line—and you'll get greater portability in your air tools . . . eliminate extra lengths of hose and miles of foot steps.

Schrader Couplers are quick . . . they're safe . . . they're sure.

To connect, just push the adapter section into the check unit. *Accidental* uncoupling is impossible—it takes a positive manual twist of the check unit sleeve to disconnect the coupler and shut off the air.

Make compressed air accessible in your plant, as the largest and most modern plants have done. Schrader Couplers are available in many pipe thread sizes and hose adapters. And remember—Schrader produces a full line of cylinders, valves and other air control equipment, to make your compressed air circuits neat . . . efficient . . . reliable. For details, write today—or fill out the coupon below.

Schrader
REG. U. S. PAT. OFF.

Leaders in air control since 1844

A. Schrader's Son
Division of Scovill Manufacturing Company, Incorporated
462 Vanderbilt Avenue, Brooklyn 38, N. Y., Dept. H-9.

I am interested in more information on _____

Name _____ Title _____

Company _____

Address _____

Just imagine drill heads you could anchor in AIR!

Think of the production possibilities . . . the tremendous time and cost savings . . . being able to locate spindles quickly in mid-air, at any angle, in any combination . . . being able to drill or tap any number of holes, simultaneously or in sequence, automatically or manually.

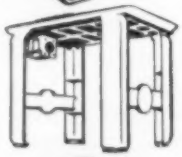
A startling concept? Using MAGNA DRILL, you can apply it right now in your own plant. Not only for special drilling and tapping jobs, but for standard operations as well.

For with MAGNA DRILL, you build the machine around the part—just as if you were anchoring the components in air instead of to the rigid steel columns that provide complete freedom of setup.

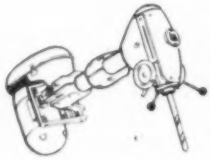
Interested? Then let us send you details, specifications and prices. Also application sheets showing how other manufacturers are making profitable use of MAGNA DRILL—complete with cost breakdowns. Simply mail the coupon.

1001 QUICK SETUPS POSSIBLE WITH MAGNA DRILL MODULAR COMPONENTS

POWER FEED (Mechanical Type). Quickly attached. Feed rates .003" to .012" per revolution. Solenoid engage. Spring return. Automatic cycling. $195*.



TABLES AND LEGS. Drilled and tapped for mounting bases horizontally or vertically. Tables may be ganged. Single table, 24"x 20," $185*. Double, 24" x 40," $235*.

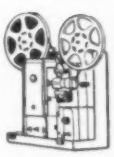


DRILL HEADS. Individually powered. Fully adjustable. Right or left hand manual feed. Choice of spindles. Price complete, less motor, $285*.

COLUMNS AND BASES. Heavy 3/8" walled tubes. 3½" O.D. Precision ground. Angle indexed. Bases are line-bored cast iron. $48*.

LEAD SCREW TAPPER. Replaces standard quill in 10 minutes. Includes reversing starter and controls, limit switch control plate, all wiring. $260*.

*F.O.B. your plant.



SEE MAGNA DRILL IN ACTION ON FILM!

Now you can see the full, dramatic, cost-cutting possibilities of MAGNA DRILL right in your own plant. A 20-minute, 16mm sound film is available for showing to interested groups wherever they may be located. Just address your request to Magna Engineering Corporation, Menlo Park, California. We'll make all the arrangements. This is one movie you won't want to miss!

MAGNA ENGINEERING CORPORATION, *Dept. 273-K, at factory nearest you*
12819 Colt Road, Cleveland 8, Ohio, OR Menlo Park, California

☐ I'm interested. Send me specifications, prices and application sheets for MAGNA DRILL.

☐ Would like to arrange a showing of the MAGNA DRILL film on or about _____ (date).

Name _____

Position _____

Company _____

Address _____

"MAGNA DRILL" FILM IS LISTED BY THE NATIONAL HEADQUARTERS OF A.S.T.E. (Speakers Directory under "Drilling"). PLAN TO SHOW IT AT YOUR NEXT MEETING.

ATRAX IN ACTION

$3,000 SAVINGS IN LABOR WITH $100 WORTH OF CARBIDE BURS

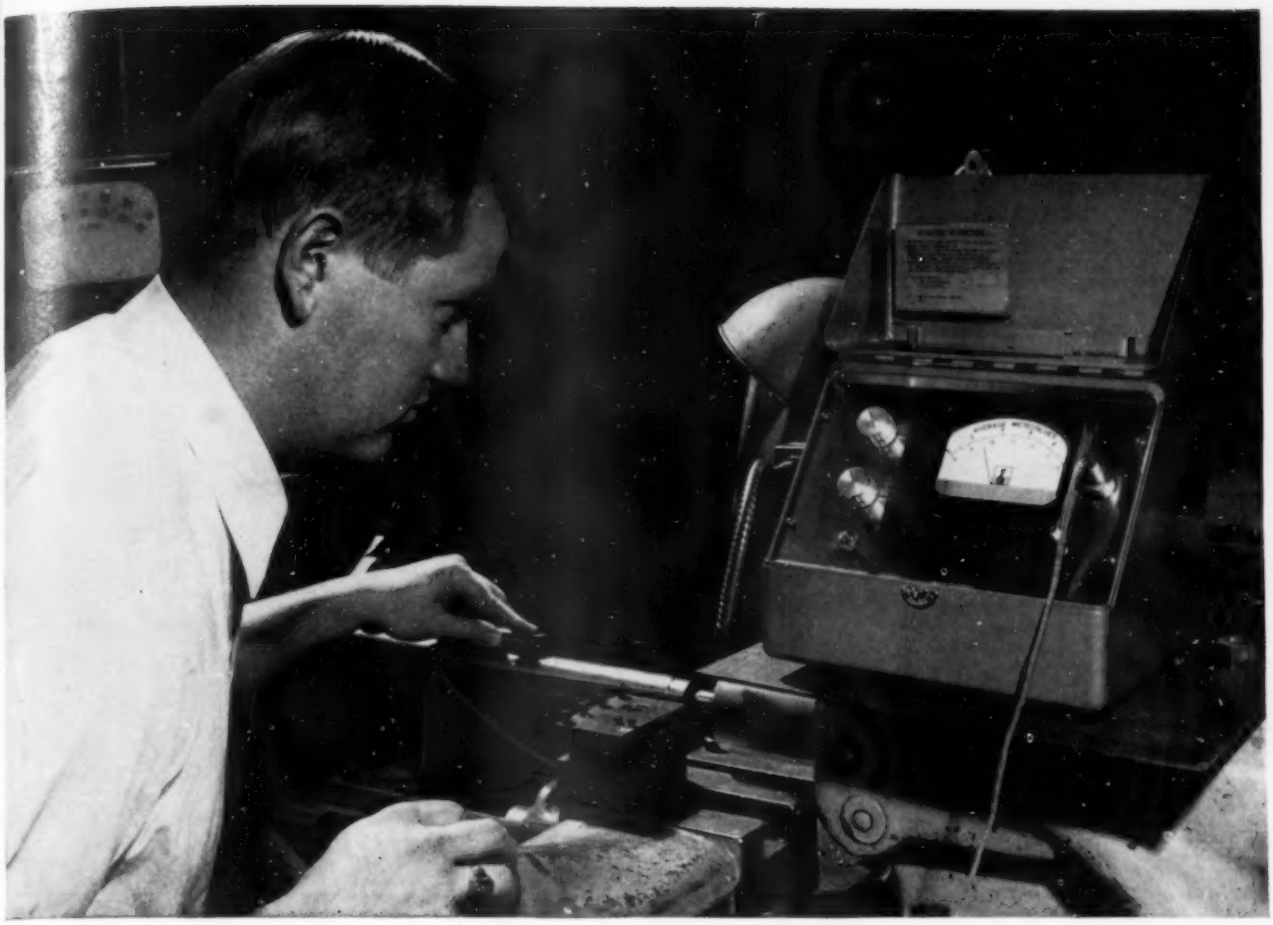
A CASE HISTORY: One of our customers had an extremely difficult problem of burring some piece parts after assembly. After consultation with Atrax engineers, it was determined that Solid Carbide Burs were the only type that could be used to salvage this huge job. Six Carbide Burs were bought for this job, totalling approximately $100.00. They saved the company over $3,000.00 in labor. Besides this, they made possible salvage of very valuable piece parts for a very nominal original investment.

Possibly our engineers or sales representatives can help YOU achieve similar savings. You'll find them in all principal cities, ready to consult without any obligation.

NEW! Complete 88-page Manual and Catalog of Carbide Tools. Write for your free copy.

THE ATRAX COMPANY

NEWINGTON 11, CONNECTICUT



BRUSH SURFINDICATOR used to measure surface roughness of a titanium bar in a test lathe, at Metcut Research Associates. The company uses the instrument in evaluation of cutting tools and fluids, and determination of machining characteristics of various metals.

"SURFINDICATOR*—Indispensable in studying machining characteristics!"

"We have found the Brush SURFINDICATOR* indispensable in our research and development programs on machineability. The evaluation of cutting tools and materials requires accurate measurements of surface finish, for which the SURFINDICATOR is a most useful tool. It can be set up quickly, it is simple to use and its small head permits measuring a wide variety of metal parts."

—Metcut Research Associates, Cincinnati, Ohio

TRY IT YOURSELF! The Brush SURFINDICATOR makes the measurement of surface roughness a quick and easy operation. It can be set up anywhere in the plant where 115 volts a.c. is available. Write for a copy of this booklet describing surface finish control—or ask for a demonstration of the SURFINDICATOR in your plant. Send coupon now. Brush representatives are located throughout the U.S. In Canada: A. C. Wickman, Ltd., Toronto. Brush Electronics Co., Cleveland 14, Ohio.

*Trade-Mark

BRUSH ELECTRONICS COMPANY

INDUSTRIAL AND RESEARCH INSTRUMENTS
PIEZO-ELECTRIC MATERIALS • ACOUSTIC DEVICES
MAGNETIC RECORDING EQUIPMENT
ULTRASONIC EQUIPMENT

formerly
The Brush Development Co.
Brush Electronics Company
is an operating unit of
Clevite Corporation.

BRUSH ELECTRONICS COMPANY, Dept. BB-9
3405 Perkins Avenue, Cleveland 14, Ohio

☐ Please send free copy of "Surface Finish Control".
☐ Have your nearest representative demonstrate the SURFINDICATOR to me.

Name _____

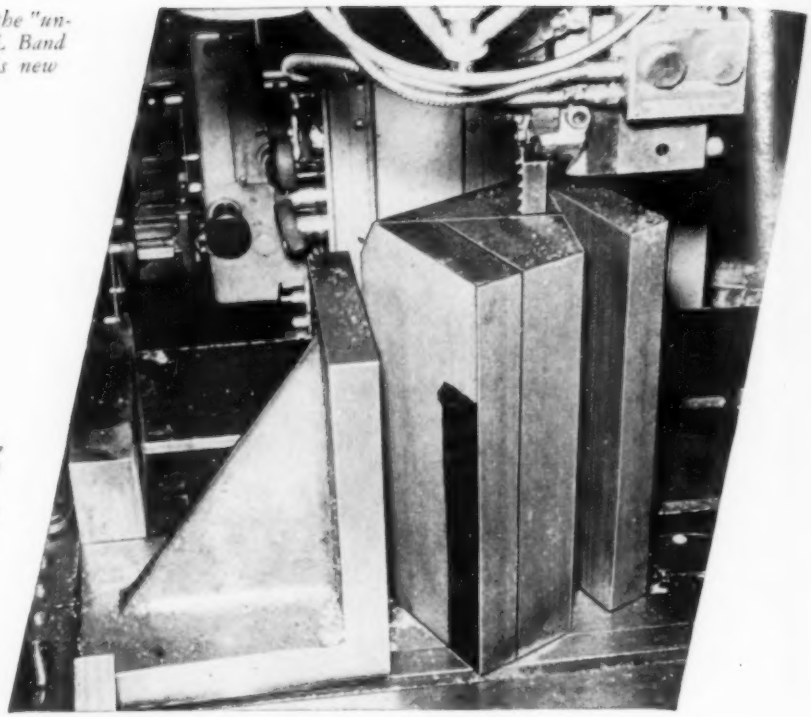
Position _____

Company _____

Address _____

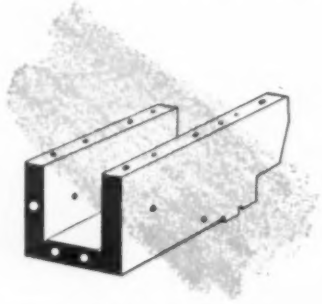
City _____ *State* _____

One of a series of advertisements explaining the "unrestricted geometry" of cutting with DoALL Band Machines and how industry is applying this new concept.



• *This slotting operation, performed in 72 minutes on a DoALL band machine, formerly took 325 minutes on a milling machine.*

A new machining concept to cut your production costs!



TIME SAVING: 7 hours, 3 minutes. Total band machining time on this part (slotting and cutting the end) is 3 hours, 12 minutes. Performing the same operations on a milling machine took 10 hours, 25 minutes.

How would your plant machine 100 duplicates of the part illustrated above? You are seeing it being made on a power feed DoALL band machine at about ⅓ the cost of milling, the previous method used.

Production band machining has come of age, with new *high speed steel* blades that last for more than 3000 square inches of cutting and cut up to five times faster than previous blades. The work is positioned on the hydraulically powered table and automatically fed into the continuous-cutting saw band. A built-in coolant system permits high cutting rates. Variable speeds and feeds and a wide range of different blades provide optimum production and finish. Machine tool accuracy is obtained.

Once you see it, you realize that band machining is the *obvious* way to do this and thousands of other production machining jobs. But, to get the savings this new concept offers, you have to look for the jobs in your shop that band machining can do faster and cheaper. A DoALL man will help you find them. He'll bring a machine to your plant and demonstrate its advantages, free of charge. Write or call. *The DoALL Company, DesPlaines, Ill.*

Free on Request, New Wall Chart "How Basic Tools Created Civilization."

DoALL

Band Machines . . . Saw Bands . . . Precision Surface Grinders . . . Black Granite Surface Plates . . . Gage Blocks and Other Precision Measuring Instruments . . . Tool Steel . . . Cutting Tools and Supplies

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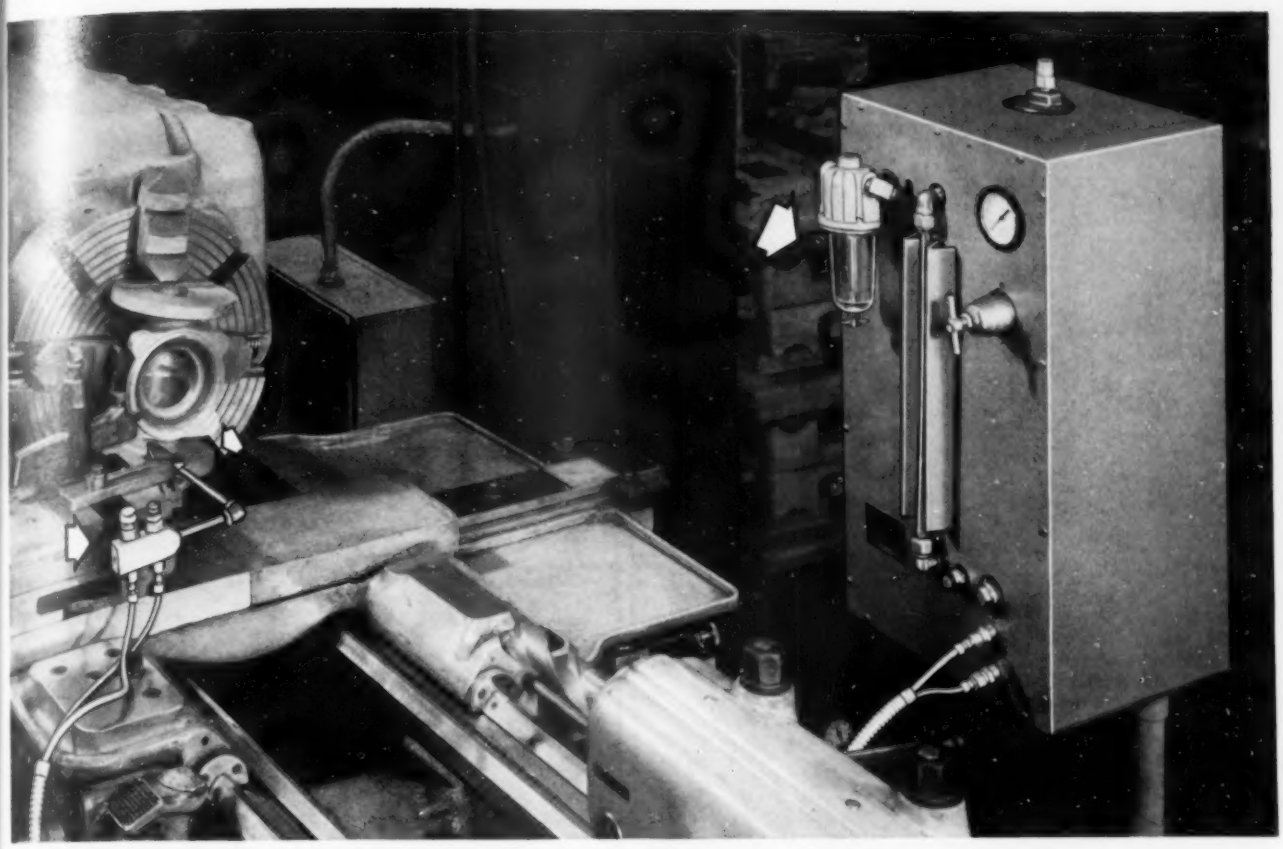
38 DoALL Stores serve industry. See classified directory for one nearest you.



LO-JET ACRO

'TURNS-OFF THE HEAT' } turns-up profits and production

Lo-Jet Cools And Lubricates

Lo-Jet ACRO is a pressurized mist system that provides both evaporative cooling of tools and work, and lubrication, to reduce friction generated heat. Because it's pressurized, Lo-Jet delivers cooling and lubrication uniformly, too, regardless of operational conditions.

Lo-Jet Pays For Itself In Reduced Costs

Lo-Jet ACRO increases tool life 100%-300%, and the resultant savings in tool cost alone soon pay for the unit. The Lo-Jet costs less to operate, too.

Lo-Jet Increases Production

With Lo-Jet ACRO on the job, you can take heavier cuts on any work, and operate at higher feeds and speeds. And because tools last longer, there is a drastic reduction in the amount of tool-change time required.

Lo-Jet Provides Better, Cleaner, Safer Operation

The directed cooling and lubrication of Lo-Jet ACRO result in improved finishes. Lo-Jet leaves the tool and work plainly visible and clean at all times. The ACRO coolant used is fireproof, lightly pine-scented, absolutely non-toxic to humans.

Lo-Jet Is Versatile And Easy To Install

Lo-Jet ACRO is completely self-contained, and can be installed on any cutting machine in minutes! It eliminates expensive, messy pumps, sumps, and piping. It can be used in turning, grinding, milling, drilling, tapping, and reaming. It's ideal for multi-phase, high speed operations, because it can be used to control as many as six nozzles at once, with full pressure and separate controls for each tool.

Don't let your profits and production go up in smoke! Mail the coupon now for literature that tells how to improve all cutting operations with

LO-JET ACRO

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GENTLEMEN: Please send me literature that fully describes the new Lo-Jet ACRO.

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FLAT LAPPING OF METALS

A view of our experimental lapping laboratory. Note how Lapmaster in foreground provides complete accessibility for loading and unloading work. In 1953 we proved to more than 200 manufacturers that lapping was profitable and solved their problems.

Our lapping laboratory is also equipped with the finest checking instruments including surface analyzers, monochromatic lights and Sheffield and Swedish gauges to insure an accurate report of every experimental job.

How to find out if you need...

Precision Flatness, Finish and Parallelity in Production Quantities

and how to get it

Over 500 manufacturers of industrial equipment including pumps, compressors, valves and controls plus many of the largest automotive and aircraft plants have found production lapping a great time and money saver in their operations. In many cases gaskets between mating surfaces have been eliminated, while in others a closer tolerance has brought about a tremendous improvement in product performance. The extreme high production accuracy of the Lapmaster (Micro-inch finishes of 2 to 3 RMS—surface flatness to less than .000011" when required) have amazed and sold many production men. This accuracy has been definitely proven on practically all materials including cast iron, steel, stainless steel, aluminum, brass, carbon, ceramics, plastics and sintered metals.

Our Lapping Laboratory Is At Your Service

There is one sure way to find out if lapping is practical and profitable for you with no strings attached. We invite you to send us a few sample parts including surface finish specifications and approximate production requirements. The parts will be lapped in our laboratory shown above and returned to you with complete facts including data on number of finished parts per hour and recommended Lapmaster size to do the work. Many companies, large and small, have already taken advantage of this free service. In a majority of cases the Lapmaster has proven its use. Why not find out for *yourself* today.

Additional Data

on the Lapmaster is available on request, also new information on Measuring Flatness. Write for your copies today.

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JOHN CRANE **CRANE PACKING COMPANY**

Index of The Tool Engineer Advertisers

September 1954 Issue

The Index to Advertisers is published as a reader service. Although every precaution is taken to assure correct listing, no allowance will be made for error or omission.

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‡USER of ASTE Data Sheets

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THESE FEATURES WILL SAVE YOU TIME AND SAVE YOUR TOOLS:

Hand Detachable—one quarter turn by hand, ***a twist of the wrist*** engages or releases cutter.

Balanced Drive—*double* lugs on cutter engage *double* abutments in holder, *double* aligning bearings for rigidity.

Extra Torsional Rigidity—drive lugs are close to seating shoulder of cutter.

Practically Indestructible—driving forces apply compression, not shearing action.

Right or Left Hand—one quarter turn locks or releases either right- or left-hand cutters.

Outside of Holder Free from Obstructions—obtainable for piloting in bushing, fluted to remove chips or threaded for stop nuts or collars.

The Continental Drive is available in standard counterbores, spot facers, countersinks, and also on special tools such as multiple-diameter cutters, step counterbores, radius and chamfering applications. It is equally applicable for inverted operations. Order through your Ex-Cell-O representative or direct from Continental Tool Works in Detroit.

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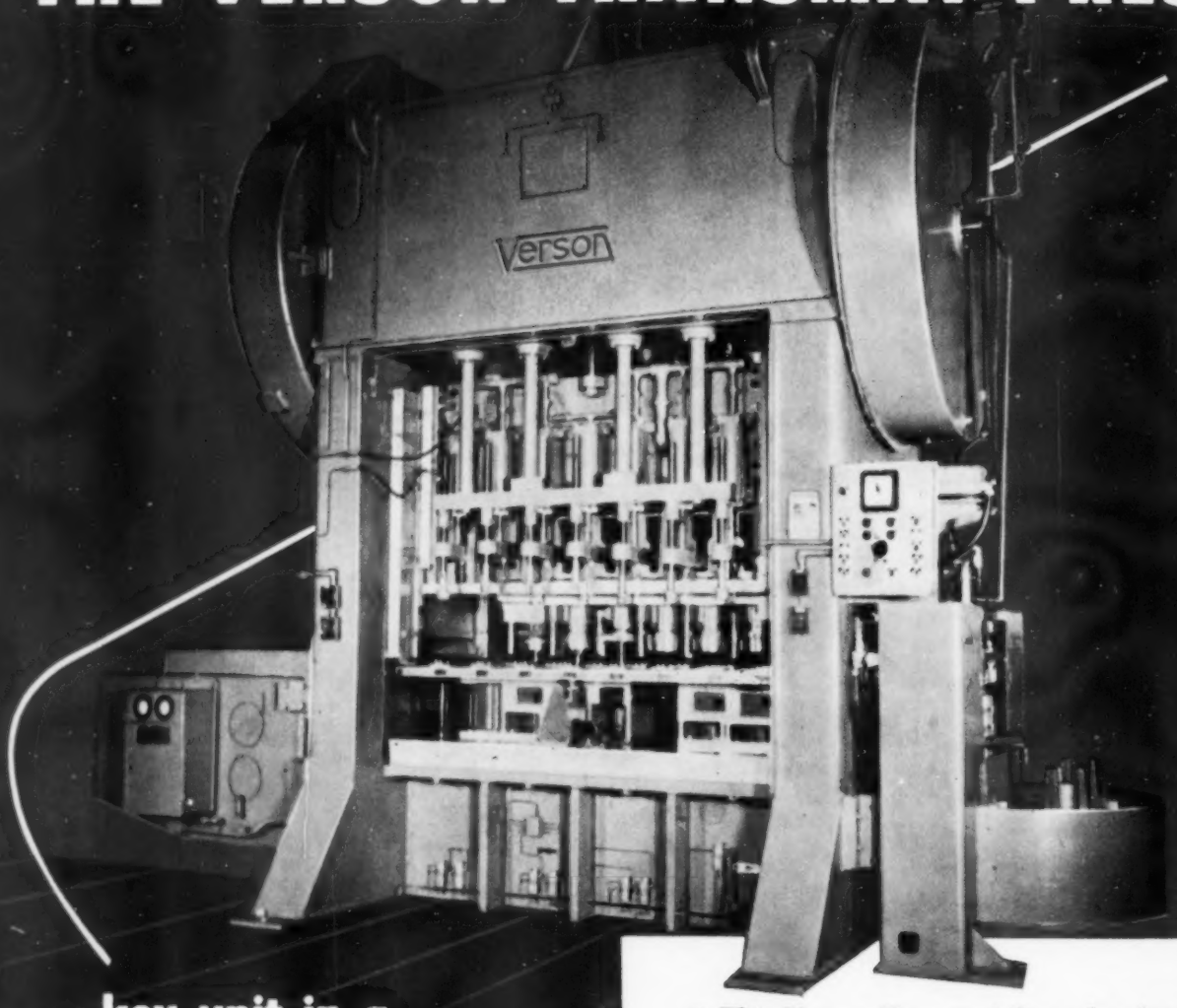

...key unit in a Verson TOOL-UP for producing 2000 motor housings per hour

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